

**EPA Superfund
Record of Decision:**

**REFUSE HIDEAWAY LANDFILL
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MIDDLETON, WI
06/28/1995**

RECORD OF DECISION

Refuse Hideaway Landfill

Town of Middleton, Dane County, Wisconsin

FINAL ACTION FOR SOURCE CONTROL AND GROUNDWATER CONTROL

Site Name and Location

Refuse Hideaway Landfill is located in the SW1/4, NW1/4, Section 8, T7N, R8E of the Town of Middleton. The 1.2 million cubic yard landfill containing municipal, commercial and industrial waste is situated in a rural surrounding that is dominated largely by agriculture.

Statement of Basis and Purpose

This decision document represents the selected final remedial action for both source and groundwater control at the Refuse Hideaway Landfill located in the Town of Middleton. This final remedial action was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP). The attached Summary of Remedial Alternatives identifies the information contained in the administrative record for this site upon which the selection of the remedial action is based.

The State of Wisconsin and the U.S. Environmental Protection Agency (U.S. EPA) concur with the selected final action.

Assessment of the Site

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the remedial action selected in this Record of Decision, may present an imminent and substantial danger to public health, welfare, or the environment.

Description of the Remedy

The selected remedies involve Alternative B, Limited Action for Source Control; Alternative F, Groundwater Extraction and Treatment with Reinjection to Enhance In-situ Bioremediation; and Alternative G, Supply Individual Water Treatment Units. These alternatives protect the public from direct contact with waste, control emissions from the landfill, remove and control contaminants within the aquifer and provide reliable potable water if additional private home water supplies become contaminated. The following specific actions are proposed:

Alternative B, Source Control Limited Action. Add deed restrictions/zoning and perimeter signs to the Site. Maintain the existing soil cap and operate and maintain the existing gas/leachate collection system. Continue to monitor 21 groundwater monitoring wells and 12 private homes for Volatile Organic Contaminants.

Alternative F, Groundwater Extraction and Treatment with Reinjection to Enhance Natural Breakdown of Contaminants. Four groundwater extraction wells would be installed on the west and south sides of the landfill and pump a total of 45 gallons per minute (gpm). Water would be treated to meet discharge standards and would be reinjected into the aquifer through two injection wells located east of the landfill. This option avoids discharge of water into Black Earth Creek, an Outstanding Resource Water and a Class 1, cold water trout fishery.

Alternative G, Supply Individual Water Treatment Units. This is a contingent option if the area of groundwater contamination moves and additional homes become contaminated. Point-of-entry (POE) treatment units would be installed at homes that become contaminated or

are imminently threatened with contamination. Currently, POE systems are successfully treating water at two homes downgradient of the landfill.

Statutory Determinations

This final remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces the toxicity, mobility or volume as a principal element because it reduces toxicity, mobility or volume.

Because this remedy will result in hazardous substances remaining on-site, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within 5 years after the commencement of this source control and groundwater control remedial action.

George Meyer, Secretary
Wisconsin Department of Natural Resources

Date

Valdas V. Adamkus, Regional Administrator
U.S. EPA Region 5

Date

RECORD OF DECISION SUMMARY
REFUSE HIDEAWAY LANDFILL
Town of Middleton, Dane County
Wisconsin

June, 1995

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RECORD OF DECISION SUMMARY

Refuse Hideaway Landfill
Town of Middleton, Dane County, Wisconsin

I. SITE DESCRIPTION

Refuse Hideaway Landfill was listed on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA) in October, 1992. Refuse Hideaway Landfill (RHL) is located in the SW1/4, NW1/4, Section 8, T7N, R8E, Town of Middleton, Dane County, Wisconsin (See Figure 1, Site location map). The 1.2 million cubic yard landfill containing municipal, commercial and industrial waste is located in a rural portion of the Town of Middleton, 2 miles west of the City of Middleton and 4 miles east of the Village of Cross Plains. According to the 1990 census, there are 3,628 persons living in the Town of Middleton.

RHL is located in the easternmost section of the upper Black Earth Creek drainage basin (Figure 2). The Black Earth Creek drainage basin has an area of 46 square miles in Dane County. The headwaters of Black Earth Creek flow to the west, essentially originating at RHL, although the drainageway exiting the RHL property is intermittent. Groundwater discharge accounts for 80% of the total flow into Black Earth Creek. Most of the groundwater discharge to Black Earth Creek occurs to the west of RHL, near the Village of Cross Plains. In the immediate vicinity of the landfill, the water table and the potentiometric surface configuration, as well as vertical gradient information confirm that Black Earth Creek is not a regional divide and the creek is not a major discharge point for groundwater in the area of the landfill. The only other surface water bodies in the area are the sedimentation basin at the landfill and several intermittent tributaries terminating at the creek. These are hydraulically connected to Black Earth Creek.

Black Earth Creek is a highly productive trout stream in southern Wisconsin and is unique for its natural reproduction of wild brown trout. The portion of Black Earth Creek nearest the landfill is classified as a Class I, cold water trout fishery. Class I trout streams support natural reproduction of wild trout and do not require stocking of hatchery trout. Wild brown trout comprise almost all of the trout population in the upper Black Earth Creek. None of the fish in the creek are known to be endangered or threatened. A 1985/86 study of Black Earth Creek indicated that the stream ecosystem is being stressed. These stresses include sediment accumulation, low dissolved oxygen concentration, increased stream temperature, and dense macrophyte growth.

Land use in the area surrounding the landfill is diverse. The landfill property itself, outside the fill boundary, is currently being rented by the landfill owner to a sand and gravel company as a storage area for truck and construction equipment. The Refuse Hideaway Landfill ROD north and west side of the landfill property are bounded by a Christmas tree farm, while the remaining area surrounding RHL is predominantly agricultural with field corn and other dairy support crops being the most common output. A small wetland area is located southeast of the landfill. Several large dairy farms and many other minor dairy farms are located in the vicinity of the landfill. In addition, several residences are located near the landfill. Most homes are located adjacent to County Highway 14 or in the Deer Run Heights Subdivision to the southwest of the landfill. Figure 3 presents the local land use around the former landfill.

Private water supply wells provide water for the residences and agricultural uses in the RHL area. Approximately 53 homes are within 1 mile of the Site. Three private wells downgradient of the landfill have had Volatile Organic Compounds (VOCs) detected in them. Figure 4 shows the locations of these wells. One of these residences is currently vacant while two others have treatment systems in place to treat the documented groundwater contamination.

The Refuse Hideaway Landfill is located in an area which has been glaciated, approximately 2.5 miles from the driftless area of Wisconsin. Unconsolidated materials in the areas adjacent to the landfill consist of Pleistocene glacial deposits, primarily till and outwash. Lacustrine sediments, consisting of layered silt and clay with a few sand layers, overlie the till and outwash deposits in some valley areas. The thickness of the unconsolidated deposits range from 5 feet thick on the north side of the Site to greater than 250 feet in the valley, half-mile southwest of the Site. Bedrock in the area consists of Cambrian sandstones overlain in some areas by Ordovician dolomites. Up to 105 feet of dolomite is present on the bluff to the northwest of the landfill. Beneath the Cambrian sandstone, the Precambrian bedrock consisting of rhyolite, granite, and basalt occurs at depths greater than 1,000 feet.

The Cambrian sandstone is the principal aquifer for Dane County. Where the thick glacial outwash deposits are saturated, they are also capable of producing large quantities of water and are the principal aquifer for several private home and farm wells located in the valley southwest of the landfill. The sandstone and the sand and gravel of the outwash deposits appear to be hydraulically connected. Figure 5 presents a regional water table map. The direction of regional groundwater flow coincides with the flow direction of Black Earth Creek Valley, flowing from the northeast to the southwest. A regional groundwater divide (separating the Wisconsin River and Yahara River watersheds) is located approximately three-quarters of a mile to the east of the RHL.

Refuse Hideaway Landfill ROD

Immediately surrounding the landfill, there appears to be a localized radial component of groundwater flow from the landfill. To the north of the landfill, groundwater at the water table flows to the north, essentially against the regional flow direction. The apparent radial flow pattern emanating from the landfill to the north appears to be limited to the upper 50 feet of the saturated strata. Groundwater flow at depth migrates to the southwest, consistent with the documented regional flow pattern to the southwest.

Groundwater flow in the unconsolidated deposits to the south and east of the landfill is to the south, while further off the Site to the south, the flow direction changes and merges with the regional flow direction which trends in a southwesterly direction. This southwesterly direction of flow is also observed within the topographic ridges to the west and southwest of the landfill.

No endangered species are known to be located in the vicinity of RHL. There are no historic landmarks that would be potentially affected by RHL.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site History

John DeBeck, the owner and operator of the Refuse Hideaway Landfill, received a landfill license from the Wisconsin Department of Natural Resources (WDNR) in 1974 to operate a 23 acre landfill. The main engineering requirement was that he maintain at least 10 feet of soil between the waste and bedrock and that he daily cover the waste. Numerous violations of the daily cover requirements are noted in the WDNR file of the Site. The Site was filled from south to north, but was not operated in "phases". Therefore, the entire waste volume (approximately 1.2 million cubic yards) was exposed to leaching by rain and snow melt throughout the operating history. The landfill owner reported receiving a variety of commercial and industrial wastes including: full barrels of glue and paint, barrels of ink and ink washes, spray paint booth by-products and paint stripper sludge, and spill residue containing VOCs. In addition, large volumes of municipal wastes from cities and towns in Dane County were also disposed of at the landfill.

John DeBeck closed the landfill under court order in May, 1988. At that time, he covered the landfill in accordance with NR 504.07, WI Adm. Code, and placed a 6 inch grading layer of coarse soil over the waste, followed by 2 feet of clay soils. Two and a half feet of general

soils were placed over the clay and 6 inches of topsoil, seeded and mulched, finished the cap. The final cover was completed in October, 1988. In January, 1989, John DeBeck declared bankruptcy and was unable to undertake additional remediation of the landfill or investigation of the degree and extent of groundwater contamination.

Therefore, in early 1989, the State of Wisconsin undertook the continued remediation and investigation of the Site, as well as all operation and maintenance activities. Costs for this work were paid by the Environmental Fund which are monies from a variety of sources, including fees paid by the owners and operators of solid waste landfills, hazardous substance generator fees, licensing fees for pesticide use and general tax revenues.

B. Response Actions

In Fall, 1989, the State began a number of actions designed to remediate the immediate problems of:

1. methane gas and leachate migration from the landfill.
2. private water supply contamination at three wells.
3. groundwater contamination and possible involvement of additional private wells.

The following actions were taken:

1. Gas and leachate extraction system. Construction of a gas and leachate extraction system was completed in August, 1991. The system consists of 13 gas/leachate extraction wells, header piping, blower, flow control systems, electrical control systems, telemetry system, a ground flare that meets all applicable air emission standards, and a leachate holding tank. Leachate is extracted from 8 of the 13 wells. The other five wells have leachate heads of less than 6 feet at the base of the wells. In Summer 1993, the gas extraction system was extended in the southwest corner of the landfill to control gas migration through the landfill cap at that location.
2. Long-term operation and maintenance of the gas/leachate extraction system. A consulting firm (Terra Engineering and Construction, Inc.) was hired in 1992 to operate and maintain the extraction system and landfill surface for up to 5 years. Besides actual O & M of the extraction system, Terra monitors gas probes surrounding the landfill for methane migration, analyzes leachate samples for compliance with a wastewater permit for discharge to the Madison Metropolitan Sewerage District, ensures subcontractors (e.g., leachate hauler) perform all duties, inspect the landfill cover for erosion problems, and ensure that applicable air emission standards are met.
3. Repair of Final Cover Soils. The landfill cover experienced significant erosion and in Fall, 1992 a cap repair and restoration project was undertaken. Geomembrane and heavy riprap was installed in the areas of worst erosion, settlement cracks were repaired, an access road over the landfill surface was constructed, top soil, seed and mulch were added to areas of sparse vegetation. At this time, the landfill surface is in fairly good repair.
4. Methane gas monitoring at private homes. In 1989 and 1990, private homes were monitored for the presence of methane gas. The homes were all in excess of 1600 feet from the landfill and no gas was ever detected in any of the homes.
5. Private Water Supply Wells. Three private water supply wells, serving three homes, were discovered to be contaminated with VOCs in January, 1988. The compounds exceeding Wisconsin NR 140 Enforcement Standards (Federal MCLs) and their maximum concentration in the private wells are:

Maximum Contaminant Concentration in Private Wells

COMPOUND	CONCENTRATION (ppb)	ES (ppb)
Tetrachloroethane	31	5
Trichloroethane	8.9	5
Vinyl Chloride	6.1	0.2
(NOTE: Vinyl chloride has not been detected since 3/88)		

The landfill owner supplied bottled water until January, 1989 at which time the State took over payment for bottled water deliveries. In Fall, 1989, testing for design of a point-of-entry (POE) water treatment system was undertaken. The system, an activated carbon filtration system manufactured by Hellenbrand Water Systems, was installed in 2 homes in April and May, 1990. The third home is no longer occupied and the water well has been shut down. The third property (owned by Randall Swanson) is used as a business and the State continues to supply bottled water to the business.

The State maintained and tested the POE systems for two years. In Summer, 1992, ownership of the POE systems was transferred to the homeowners. Each homeowner is now permanently responsible for maintenance and testing of the POE system in that home. All testing to date indicates that the filtration systems reliably produce safe, drinkable water.

6. Testing of Private Water Supplies Within One Mile of the Landfill. In Fall, 1989, 43 private water supply wells (serving 53 homes) were tested for the presence of Volatile Organic Chemicals. Two testing rounds were conducted, in October, 1989 and January, 1990. The tests showed that all private wells (except the 3 previously mentioned) were free of VOCs. In one of the testing rounds, toluene was detected at approximately 1 ppb in several private wells. Laboratory contamination is believed responsible for this. Subsequent testing showed all VOCs to be below detection at all the homes.
7. Groundwater Monitoring Study. In Summer, 1990, the State undertook an intensive groundwater investigation to determine the degree and extent of VOC contamination. Hydro-Search, Inc. of Brookfield, WI performed the investigation. Twenty-seven groundwater monitoring wells were installed. There were 30 existing monitoring wells at the Site, for a total of 57 monitoring wells in the study. (See Figure 7) The study evaluated the geology, the vertical and horizontal groundwater flow, the average groundwater velocity in each geologic unit, the extent of aquifer contamination, the direction of plume movement, preliminarily evaluated four remedial actions, and made recommendations on future work at the Site. The study showed that the groundwater plume has the potential to contaminate the Deer Run Heights subdivision, located approximately 1 mile southwest of the landfill. In January, 1991, the State began monitoring private wells in the eastern portion of Deer Run Heights.

Contaminants detected above WONR Enforcement Standards (Federal MCLs) and their maximum concentrations detected in the groundwater at RHL, include:

Maximum Contaminant Concentration in Groundwater

COMPOUND	CONCENTRATION (ppb)	ES (ppb)
Benzene	20	5
Chloroform	37	6
1,2-Dichloroethane	41	5
cis-1,2-Dichloroethene	1,900	70
1,2-Dichloropropane	21	5
Tetrachloroethene	150	5
Trichloroethene	160	5
Vinyl Chloride	525	0.2

8. Numerical Model Simulation and Assessment of Contaminant Plume Migration. In Summer, 1991, a numerical model was performed by Hydro-Search, Inc. (HSI) in an effort to estimate movement of the plume front downgradient of the landfill. A number of simulation scenarios were performed, resulting in a range of possible outcomes. The modeling effort provided an evaluation of the State's groundwater monitoring strategy and suggested that at least one additional monitoring well be installed in the Black Earth Creek Valley. The study concluded that it is unlikely that the plume front will move beyond its present location, however, the possibility of future plume movement could not be ruled out.
9. Testing for metals, semi-volatiles compounds, pesticides and PCBs. In May and July 1993, 18 monitoring wells and 2 contaminated private wells were tested for the presence of metals and semi-volatile compounds (SVOC). Three wells near the landfill with high levels of VOCs were also tested during the same period for the presence of pesticides and PCBs. In general, metals were detected at background levels, no PCBs were detected, a low level of one SVOC (bis (2-ethylhexyl)phthalate) was confirmed at one well and one low level pesticide (heptachlor) was confirmed at one well. A low level of 4,4'-DDT was detected but not confirmed in one well.
10. Long term groundwater monitoring. The State has established a long-term groundwater monitoring program that monitors the movement of the plume and tests private wells closest to the plume. Testing for VOCs is conducted semi-annually (in May and October) on 21 monitoring wells and 12 private wells.

C. Civil Actions/Suits

Several civil actions have been undertaken with regard to RHL. The following summarizes these actions:

1. Action to Close the Landfill. On May 2, 1988, WDNR issued Special Consent Order #SOD-88-02A requiring closure and monitoring of RHL. John DeBeck stopped accepting waste on May 16, 1988 and covered the landfill in accordance with NR 504.07, Wis. Adm. Code. On August 16, 1988, the WDNR referred John DeBeck to the Wisconsin Department of Justice for non-compliance with Special Order #SOD-88-02A. On December 30, 1988, DeBeck entered into a Stipulated Agreement with the State of Wisconsin to complete specified work at the landfill. On March 17, 1989, John DeBeck was issued a Contempt Order for failing to comply with the December 30, 1988 stipulated agreement. The Contempt Order provided for

DeBeck to liquidate all the assets of the Refuse Hideaway Landfill Corporation and deposit the money into the WDNR "Waste Management Fund" to pay for future cleanup at the landfill.

2. John DeBeck v, WDNR. The WDNR issued a "Conditional Closure Plan Approval Modification" on September 6, 1988. The closure plan approval required John DeBeck to undertake specific actions with regard to closure of the landfill. On October 6, 1988, John DeBeck challenged the WDNR's authority to issue the closure plan modification to him rather than Refuse Hideaway, Inc. The trial court and appellate court vacated the DNR orders by finding that Refuse Hideaway, Inc. was the owner/operator of the landfill and that the State could not impose liability on John DeBeck, as a former owner/operator under the State's Solid Waste Statute (WI Stat. Sec. 144.44).
3. Stoppleworth, ex rel., Schultz, ex. rel, vs. Refuse Hideaway, Inc., et. al. Two home owners (Al & Jean Stoppleworth and Craig & Anita Schultz) whose wells were contaminated by the landfill sued insurance companies for Refuse Hideaway, Inc. in Summer, 1991 for damages they suffered due to loss of home value and possible health effects from the contamination. The jury found for the plaintiffs and an undisclosed settlement was reached with the insurance companies involved.
4. Sunnyside Seed vs, Refuse Hideaway, Inc., et. al. In Summer, 1993 Randall Swanson sued insurance companies for Refuse Hideaway, Inc. for damages due to groundwater contamination under much of his property and the loss of use his water well. The jury found for the defendants. The verdict was affirmed on appeal (1995).
5. John Stoppleworth vs. Refuse Hideaway, Inc., et. al. In Summer 1993, John Stoppleworth (son of Al Stoppleworth) sued insurance companies for Refuse Hideaway, Inc. for health impacts from using water at his parent's home. Stoppleworth claimed that skin cancer he suffered was due to VOCs in the home well water. The jury found for the defendants. The verdict was affirmed on appeal (1995).

D. Remedial Investigation/Feasibility Study (RI/FS)

In May 1991, the WDNR offered to enter into a contract with a group of PRPs to undertake an remedial investigation and feasibility study (RI/FS) at RHL. After being unable to secure an agreement, and after reviewing data from this Site, the WDNR recommended to EPA that the Site be included on the National Priorities List (NPL). The Site was listed on the NPL in October 1992. A Cooperative Agreement was signed between U.S. EPA and WDNR in April 1993 allowing the WDNR to act as lead agency in performing a RI/FS pursuant to s. 144.442, Wisconsin Statutes and the Comprehensive Response, Compensation and Liability Act ("CERCLA"). The RI/FS for this Site was financed by the federal Superfund program. The WDNR secured a consultant, Hydro-Search, Inc., and the RI/FS officially began in October 1993.

The RI for RHL was completed September 1994 and the FS was completed in February 1995. The WDNR issued a Proposed Plan in February 1995. The Proposed Plan selected Alternatives B (Limited Action for Source Control), Alternative F (Groundwater Extraction and Treatment with Reinjection to Enhance In-Situ Bioremediation) and Alternative G (Supply Individual Water Treatment Units) as the Final Remedy for the Site. Data submitted during the public comment period caused WDNR to retain the proposed plan. Factors considered by WDNR in making it's decision are listed in Section III, Highlights of Community Participation.

III. COMMUNITY PARTICIPATION

A Community Relations Plan for the Site was finalized in June 1994. This document lists contacts and interested parties throughout the local and government community. It also establishes communication pathways to ensure timely dissemination of pertinent information. An information repository has been established at the City of Middleton Library located at 7426 Hubbard Avenue, Middleton, WI. The administrative record is made available to the public at the Department of Natural Resources, 101 S. Webster St., Madison, WI 53707.

The Proposed Plan (in the form of a Superfund Fact Sheet) for the Refuse Hideaway Landfill was released to the public in February 1995. The notice of availability for the Proposed Plan and the RI/FS was published in:

1. Cross Plains Arrow on February 2, 9 and 16, 1995.
2. Middleton Times-Tribune on February 2, 9 and 16, 1995.
3. Capital Times and Wisconsin State Journal on February 11, 1995.

A public comment period was held from February 13 until March 14, 1995. In addition, a public meeting was held on February 23, 1995. At this meeting, members from WDNR and U.S. EPA answered questions about problems at the Site and the remedial alternatives under consideration. A response to comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision.

A chronology of other community relations activities for this Site follows.

Public Meetings

All public meetings listed below were announced through a press release and the distribution of a fact sheet.

November 13, 1989. This meeting discussed the Interim Remedial Measures contract between WDNR and Warzyn Engineering, Inc. The contract called for design of point-of-entry treatment systems for contaminated home wells, sampling of private wells for VOCs within 1 mile of the Site and design of a gas/leachate extraction system for the landfill.

February 28, 1990. This meeting updated the public on results of the first sampling round of private wells, installation of the "partial gas/leachate extraction system" used to design the full extraction system, and design of the point-of-entry treatment systems for contaminated private wells.

July 10, 1990. This meeting discussed the contract for the Groundwater Monitoring Study between WDNR and Hydro-Search, Inc. of Brookfield, WI. The investigation goals included installation of 22 additional monitoring wells, groundwater testing for VOCs, determining degree and extent of aquifer contamination, and evaluation of groundwater discharge to Black Earth Creek.

October 2, 1990. This meeting updated the public on emergency erosion control measures undertaken at the landfill in July 1990, preliminary work on the Groundwater Monitoring Study, and the design and award of a construction contract for the full gas/leachate extraction system for the landfill.

June 25, 1991. This meeting concentrated on the results of the Groundwater Monitoring Study and delineation of the contaminant plume. Completion of the full gas/leachate was also discussed.

July 8, 1992. This meeting updated the public on on-going operation and maintenance activities at the Site, including operation of the gas/leachate extraction system and monitoring of groundwater and private home wells. An Erosion Control contract between Dames & Moore and WDNR was discussed. Proposal of Refuse Hideaway Landfill for Superfund status was also discussed.

May 6, 1993. A Superfund Fact Sheet was issued and a meeting was held to provide a summary of the Site history, explain the Superfund process and delineate the approved RI work plan. The Wisconsin Department of Health and Social Services (WDHSS) also participated to discuss their role in the RI/FS and the Health Assessment that would be developed.

July 7, 1994. A Superfund Fact Sheet was issued and a meeting was held to discuss on-going Superfund activities, including the draft RI and Alternative Array Document. Operation and

maintenance activities at the Site were also discussed. WDHSS personnel attended and discussed the Preliminary Health Assessment.

Technical Availability Sessions

December 19, 1989 and January 24, 1990. These two availability sessions gave the public the opportunity to speak personally with WDNR and engineering consultant staff. These were "drop-in" sessions with no formal agenda. These were announced to the public through press releases and mailings, but no fact sheets were prepared. Approximately 10 to 15 people attended each session.

Landfill Open House

October 14, 1993. An open house was held at the landfill to allow the public to view the remedial activities that had been completed on the landfill (e.g., gas/leachate extraction system and cap repair and restoration work) as well as ask questions of the key personnel from the WDNR and WDHSS. Approximately 30 people attended the open house.

Public Health Interviews

July, 1993. As part of the Community Relations plan and Health Assessment for the Site, WDNR and WDHSS personnel conducted interviews in private homes of over 50 residents in the Towns of Middleton and Cross Plains. Residents were notified of these interviews and all who showed interest in participating were interviewed.

Conclusion

The public participation requirements of s. 144.442(6) (f), Wisconsin Statutes, and the community relations requirements in the National Contingency Plan at 40 CFR s. 300.430(f) (3) have been met in this remedy selection process. All the documents listed above are available in the Administrative Record at the City of Middleton Public Library and the WDNR office (addresses for both are listed above). (A copy of the Administrative Record is also available at the U.S. EPA offices at 77 West Jackson Boulevard (7th Floor Records Center), Chicago, Illinois.)

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

The response actions selected by this ROD address the following areas:

- long-term source control at the landfill
- control and treatment of contaminated groundwater
- replacement of contaminated water supplies, if needed.

Previous actions taken by the State of Wisconsin have addressed the threat posed to human health and the environment by the landfill itself. The methane gas and leachate extraction system constructed in 1991 controls the movement of potentially explosive gases and meets all applicable air emission standards. This system also removes contaminated liquid from the landfill and reduces the movement of contamination into the groundwater beneath the landfill. The landfill cap has been repaired and upgraded to prevent direct contact with waste. This ROD addresses the long-term protectiveness of the landfill cap and the long-term operation and maintenance (O&M) of the gas/leachate extraction system.

The State of Wisconsin installed point-of-entry (POE) treatment systems in two private homes to remove contaminants from the home wells. The State also undertook a groundwater investigation to define the degree and extent of groundwater contamination. At this time, contaminated groundwater at the Site poses a potential future threat to human health and the environment because of risks from possible ingestion of or dermal contact with the groundwater should the groundwater contamination spread, should the POE units not be maintained or should new wells be installed in the contaminated zone.

The selected remedial actions, described as Alternative B, Limited Action for Source Control, Alternative F, Groundwater Extraction and Treatment with Reinjection to Enhance In-Situ Bioremediation, and Alternative G, Supply Individual Water Treatment Units address the principal threats posed by Site conditions by eliminating the potential for direct contact with contaminants of concern, controlling and treating groundwater contamination and treating private water supplies in the event they become contaminated in the future.

These combined actions are intended to address the entire Site with respect to the current and potential future threats to human health identified in the RI, FS and the Site Baseline Risk Assessment.

V. SUMMARY OF SITE CHARACTERISTICS

A. Topography

Regional topographic variation is extreme in Dane County near RHL (Figure 1). Local topographic relief in excess of 200 feet is common in the vicinity of the landfill. Bluffs with peak elevations often greater than 1,150 feet mean sea level (msl) are present along the north and west sides of the landfill, while the south and east sides of the landfill have ground surface elevations as low as 930 feet msl.

B. Geology/Hydrogeology

The geology in the vicinity of RHL is typical of the glaciated portion of Dane County, Wisconsin. Unconsolidated deposits of glacial origin consisting of till, outwash, and glacial lake sediments cover the area, often reaching thicknesses of several hundred feet. Bedrock in the area consists of Cambrian sandstones overlain in some areas by Ordovician dolomites. Beneath the Cambrian sandstone, the Precambrian bedrock consisting of rhyolite, granite, and basalt occurs at depths greater than 1,000 feet. The Cambrian sandstone is the principal aquifer for Dane County. Saturated, thick glacial outwash deposits also produce large quantities of water and are the principal aquifer for several wells located in the valley southwest of the landfill.

Figure 6 shows the physiographic areas and glacial-age deposits in the area of RHL. Glacial materials include both outwash and till; lacustrine sediments consist primarily of layered clay and silt. Thickness of the unconsolidated deposits encountered at RHL range from 5 feet thick on the north side of the landfill (at P-17S location) to greater than 250 feet thick approximately ½ mile southwest of the landfill (at P-31 location). (See Figure 7) The fine-grained lacustrine deposits overlie sandstone or outwash and are primarily found east and southeast of RHL. The grain size analysis shows the unconsolidated materials to be quite variable in composition, ranging from fine-grained samples with 98% clay and silt to coarse-grained samples with 46% gravel and 48% sand. Most samples consisted of a mixture of fine and coarse grains.

The bedrock in the RHL area consists of Ordovician Prairie Du Chien dolomite, which caps the bluffs of the region but is absent in the valleys. Up to 105 feet of dolomite is present at the P-17 location (Fig. 7) on the bluff to the northwest of the landfill. Cambrian sandstone of the Trempealeau Group underlies the dolomite. The bedrock is exposed at the ground surface in some areas of the landfill property and at a road cut along U.S. Highway 14, southwest of the landfill. Fracturing of the bedrock is visible in the outcrops.

In the RHL area, the water table can occur in the unconsolidated deposits or in the bedrock. The sandstone of Late Cambrian age and the sand and gravel of the outwash deposits appear to be hydraulically connected. Groundwater occurs under unconfined conditions in most of the area. Figure 5 presents a regional water table map. Hydraulic properties of the outwash deposits and the Cambrian sandstones are comparable. Hydraulic conductivities of both units are high. Monitoring wells screened in the sand and gravel exhibited average hydraulic conductivity values of 1.1×10^{-2} cm/sec., those screened in sandstone have values of 2.2×10^{-3} cm/sec, and those in dolomite average 5.6×10^{-3} cm/sec.

The direction of groundwater flow generally coincides with the orientation of the Black Earth Creek Valley, flowing from northeast to the southwest. Immediately surrounding the landfill, there appears to be a localized radial component of flow from the landfill apparently due to groundwater mounding beneath the landfill. To the north of the landfill, groundwater at the water table flows to the north, essentially against the regional flow direction. Groundwater flow at depth (see potentiometric surface maps, Figure 8) moves to the southwest, consistent with the regional flow pattern. The apparent radial flow pattern emanating from the landfill to the north appears to be limited to the upper 50 feet of saturated thickness. An unsaturated zone likely exists between the base of the landfill and the water table, based on significant elevation differences between leachate levels within the landfill and groundwater elevations. The elevation difference between leachate elevation and groundwater elevation is approximately 36 feet in the northern portion of the landfill and 59 feet in the southwest portion of the fill area.

Groundwater flow in the unconsolidated deposits to the south and east of the landfill is to the south, while further off the Site to the south, the flow direction changes and merges with the regional flow direction which trends in a southwesterly direction.

The Deer Run Heights subdivision is located over a mile southwest of the landfill, in the Black Earth Creek Valley. The subdivision is located on a "bedrock ridge" in the valley. The groundwater elevations within the ridge tend to mirror that of the surrounding valley. In 1991, groundwater in the unconsolidated valley deposits appeared to flow through the bedrock of the Deer Run Heights ridge. The similarities of the hydraulic conductivities between the sand and gravel and the bedrock aquifers was thought to account for this observation. In 1993 groundwater elevations increased significantly and groundwater flowed north and northeast into the valley from the Deer Run Heights ridge. The increased volume of water moving through the valley appears to preferentially move from the bedrock to the sand and gravel where the thick unconsolidated deposits allow the water to migrate more easily than in the bedrock.

C. Nature and Extent of Contamination

1. Source

A ravine in a bluff adjacent to and north of the Black Earth Creek Valley was used to construct and operate the Refuse Hideaway Landfill. (See Figure 1) The 1.2 million cubic yard landfill operated between 1974 and 1988 and contains municipal, commercial and industrial waste. Wastes that were disposed of at the Site included full barrels of glue and paint, spray paint booth by-products and paint stripper sludge, and spill residues containing Volatile Organic Compounds. (Ref: State Hazard Ranking System Narrative, WDNR). Source control actions, including capping the landfill and gas/leachate extraction control direct contact with waste, surface water contact, and air emissions from the landfill. Previous and on-going contamination continues to affect groundwater at the Site.

2. Groundwater Contamination

Lateral Extent of Contamination

Groundwater is the main pathway of concern for contaminant migration at the Site. In general, groundwater flows beneath the landfill and moves southwest to the Black Earth Creek Valley. The main contaminant plume extends 3,800 feet southwest of the landfill. Contamination extends radially from the landfill up to 1,500 feet north and east apparently due to groundwater mounding beneath the landfill. Lateral extent and concentration of the plume with respect to total VOCs is delineated in Figure 10. The 1991 VOC data were used to construct plume figures because all functional wells were sampled in 1991 and more recent sampling events have involved fewer wells. The groundwater modeling completed in 1993/4 indicates that contaminant migration occurs primarily within the sand and gravel deposits in the valley. Bedrock migration of contaminants downgradient appears to occur where fractures intersect the sand and gravel deposits within the valley. The rate of groundwater flow near

the landfill is much greater than downgradient of the landfill due to the steep gradients near the landfill. Flow rates near the landfill range from 1.68 ft/day (sandstone) to 3.8 ft/day (sand & gravel). Downgradient of the landfill, flow rates range from 0.11 ft/day (sandstone) to 0.24 ft/day (sand & gravel).

Vertical Extent of Groundwater Contamination

The vertical extent of groundwater contamination is illustrated in Figure 9. Vertical gradients are downward throughout the aquifer in the study area. Near the landfill, contamination extends to about 800 feet msl. The plume deepens to 700 feet msl downgradient. In 1992, a new water supply well was drilled on the Schultz property. The well extends to a depth of approximately 500 feet msl and is cased to 600 feet msl. VOCs were detected in the new Schultz well, indicating that contaminants are present below 700 feet msl. The VOC impacts in the Schultz well may be related to a preferential migration pathway in the fractures of the bedrock. The contaminant plume does not appear to extend below 700 feet msl in the unconsolidated deposits. The vertical extent of the plume at P-31 (located near the middle of Black Earth Creek Valley), does not extend into the bedrock, which has an elevation of approximately 700 feet msl, however it does extend into the unconsolidated sand and gravel deposits, to an elevation of at least 780 feet msl.

Water Quality Results

Groundwater has been sampled for inorganic compounds, metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and PCBs. The primary contaminants emanating from the landfill and which define the groundwater plume are VOCs. (See Figure 9 and 10 for the vertical and horizontal plume location.)

VOCs

A summary of U.S. EPA MCL and WDNR NR 140 exceedances is provided in Table 1; locations of monitoring wells are shown in Figure 7. Eight compounds, including benzene, chloroform, 1,2-DCA, cis-1,2-DCE, 1,2-Dichloropropane, PCE, TCE and vinyl chloride were detected in concentrations which exceed the NR 140 ES. PCE is the most pervasive of the compounds in the groundwater. Individual maximum chemical concentrations and well locations are listed below.

Maximum VOC Groundwater Concentrations and Well Location

Constituent	Concentration	Well Location
Benzene	20	P-9S
Chloroform	37	P-21S
1,2-Dichloroethane	41	P-9S
cis-1,2-Dichloroethene	1,900	P-17S
1,2-Dichloropropane	21	P-9S
Tetrachloroethene	150	P-27S
Trichloroethene	160	P-17S
Vinyl Chloride	525	P-21S

Metals

The only compounds detected above NR 140 ESs were manganese (21 wells) and iron (18 wells). The manganese concentrations ranged from below the quantification limits to 2.6 ppm (ES = 0.5 ppm). The variation in manganese levels near the landfill appears to be related to proximity to the RHL while at outlying wells no landfill relationship to manganese is notable. Dissolved iron levels near the landfill are high due to proximity to the RHL. The highest concentration was observed at P-4S at 72 ppm. Outlying wells had dissolved iron concentrations ranging from less than 0.02 ppm to 5.42 ppm (ES = 0.3 ppm). The iron concentrations in outlying wells are likely the result of naturally occurring iron, based on normal background concentrations and dissolved iron distributions.

In conclusion, iron and manganese levels beyond the landfill property appear to reflect natural background concentrations in the aquifer. Iron and manganese levels are elevated in monitoring wells near the landfill due to the impact of landfill leachate.

Semi-Volatile Organic Compounds

Two sampling events, conducted in May and October 1993 positively identified one SVOC - bis(2-ethylhexyl)phthalate at 3 ppb and 4 ppb in one well (P-21D). The Enforcement Standard for bis(2-ethylhexyl)phthalate is 3 ppb, the PAL is 0.3 ppb. Because this compound was detected in only one well, it is concluded that semi-volatiles are not a contaminant of concern at the landfill. However, the water treatment will be designed to remove any semi-volatiles from extracted groundwater.

Pesticides/PCBs

Three wells were sampled for TCL (Target Compound List) pesticides and PCBs in May and October 1993. No PCBs were detected. Heptachlor was the only confirmed pesticide detected in one well (P-21S) at 0.012 ppb and 0.010 ppb. These detections are below the PAL for heptachlor (PAL = 0.04 ppb). One other pesticide, 4,4'-DDT, was detected once at 0.075 ppb at well P-17S, but not confirmed. Pesticides and PCBs are not a contaminant of concern at the landfill.

Private Wells

Private home wells serving 53 homes within 1 mile of RHL have been tested for the presence of VOCs. Three private wells are contaminated with VOCs. (See Figure 4 for locations) One well (Swanson) has been shut down since early 1991. The other 2 wells (referred to here as Schultz and Stoppleworth) have point-of-entry treatment systems installed to treat VOC contamination. Samples for metals and SVOCs were analyzed in May and October 1993. All private well sample results have been sent to the owners of the homes tested.

Metals

Both the Schultz and Stoppleworth wells exceeded NR 140 ES for iron in October 1993. Manganese exceeded NR 140 PAL levels for both samples collected at the Stoppleworth residence. Iron and manganese are typically high in the area and these detections are likely due to naturally occurring iron and manganese.

The October 1993 sample from the Schultz well exceeded the PAL for lead. Because the PAL for lead was not exceeded in any of the monitor well samples, the detected lead is likely due to piping for the house and not to effects of the landfill.

VOCs

Numerous rounds of VOC sampling have been conducted on various private wells. Table 2 summarizes the VOC detections in the private wells. POE water treatment units were installed in two of the wells (Schultz and Stoppleworth) while the third well was taken out of service. The compounds exceeding WDNR ES standards and Federal MCLs are tetrachloroethene (PCE) and

trichloroethene (TCE).

Maximum Concentrations Detected in Private Wells, Exceeding Drinking Water Standards(ppb)

Name	PCE	TCE
Schultz	28	8.9
Stopplesworth	31	8.2

SVOCs

No SVOCs were detected in the May 1993 sampling round. In October 1993, bis(2-ethylhexyl)phthalate was detected in both well samples at concentrations of 92 ppb (Schultz) and 45 ppb (Stopplesworth). These detections are likely due to introduced contamination during sample collection/handling and not related to landfill effects.

Groundwater Modeling

In 1992, a groundwater flow model (MODFLOW) and contaminant transport model (MT3D) were used to predict plume movement at the leading edge of the plume in the Black Earth Creek valley. The results of that modeling effort are reported in "Numerical Model Simulation and Assessment of Contaminant Plume Migration, Refuse Hideaway Landfill, Middleton, Wisconsin". A conclusion of the report is that under the assumption that the source of impacts does not significantly increase (i.e., VOC concentrations within the contaminant plume stay the same, decrease, or increase by less than 1 order of magnitude), the plume will reach an equilibrium condition after a period of approximately five years (1996) due to dilution, dispersion, and degradation processes. Due to uncertainties within the model, there is a possibility the plume will migrate beyond it's present location, however it is not expected to do so. The modeling provided the following predictions: If the source of contamination is eliminated, equilibrium will be achieved in about two years. If the source of groundwater contamination is eliminated, these natural processes (dilution, dispersion, and degradation) will remediate the downgradient portions of the aquifer not remediated by elimination of the source and there will be no additional plume migration.

3. Surface Water/Sediments

Sampling of surface water and sediments was not conducted during the RI. In 1987, before the landfill cap was installed, 4 surface water samples were collected from the sedimentation basin and drainage ditch near the landfill. There were no detectable VOCs in 2 of the samples. The other samples contained detectable levels of methylene chloride, 1,1-DCE, 1,2-DCE, bromoform, and toluene below quantification limits. In addition MEK was detected at up to 290 ppb. Capping of the landfill eliminated the potential for precipitation to become contaminated by coming in contact with exposed waste. In 1992, the sedimentation basin was drained and the sediment in the basin was removed. Together, capping and sediment removal activities eliminated the sedimentation basin as a potential source of contamination. In July 1989, the WDNR collected surface water samples from Black Earth Creek, two tributaries, and a drainage ditch near the landfill. No VOCs were detected in any of these samples. These sample results indicate that the landfill cap removed the contaminated runoff source for surface water contamination. Groundwater sampling in the water table wells located near Black Earth Creek indicate that Black Earth Creek is currently not being affected by the groundwater contaminant plume.

4. Air

No specific ambient air sampling has been conducted at the Site. Source control has been undertaken at the Site in the form of landfill containment (capping) improvements and maintenance, thereby eliminating the potential for contaminated airborne dust being released to the atmosphere. The landfill gas collection and destruction system is tested in accordance with WDNR administrative code requirements. The destruction system (enclosed

flare) meets all air been eliminated.

VI. SUMMARY OF SITE RISKS

A. Human Health Risk Assessment

A qualitative risk assessment was completed for the Site. The purpose of the assessment was to identify human health hazards posed by environmental contamination from the Site. The qualitative risk assessment evaluates current as well as future potential exposures to Site related contamination. Sample results from the remedial investigation were used to evaluate all environmental pathways with potential human exposure routes.

The reasons that a qualitative, rather than a quantitative, risk assessment was completed include:

- state standards for air and water quality are protective of human health and the environment
- the remedy must comply with state standards
- an EPA guidance document (Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, February 1991, OSWER Directive 9344.3-11) states that exceedances of state standards, as opposed to the Site representing an unacceptable risk, are a cause for action at Superfund municipal landfill sites.

A copy of the qualitative assessment is in the RI report, and includes standards of contaminants of concern, exposure assessment and environmental assessment. Presented below is a brief summary of the assessment and its conclusions.

During the RI, samples were taken of landfill gas, leachate, and groundwater. Surface water and sediment samples were not collected during this investigation because the clay cap, installed over the landfill in 1988, is expected to contain contaminants and prevent surface water from coming in contact with wastes. Sediments originating at the landfill collected in the sedimentation basin located in the southeast corner of the landfill property. These sediments were excavated and removed, thus eliminating this environmental pathway from the pathways of concern. The results of the RI sampling as it relates to each environmental exposure pathway are summarized below.

1. Air

Landfill gas, consisting primarily of methane, has the potential to migrate from the Site and is a potential explosive hazard to persons living and/or working in buildings near the Site. Monitoring throughout 1990 did not reveal any landfill gas in nearby homes, though it was detected at potentially explosive levels in a commercial building on the Site, adjacent to the landfill.

Other toxic substances such as VOCs can co-migrate from the landfill with the methane. On-site landfill gas samples were analyzed for constituent VOCs as part of planning and designing a gas extraction system to control the migration of gas away from the landfill. The following VOCs were detected in the on-site landfill gas: benzene, PCE, toluene, TCE, and vinyl chloride. No gas samples for VOC analysis were collected from the building that contained potentially explosive methane concentrations. The highest detected VOC values in the landfill gas are presented in Table 3. The VOC concentrations detected in the landfill gas samples are not necessarily indicative of the levels that could exist in ambient air. When gas migrates to the ambient air, concentrations drop rapidly due to dilution, dispersion, and degradation.

Benzene, PCE, toluene, TCE, and vinyl chloride are all potential contaminants of concern for the air pathway because the highest detected levels exceed the comparison value for these compounds. The air pathway has been addressed with the installation and operation of a ground flare. The design temperature and gas residence time (1,500° F for 0.5

seconds) ensures that the toxic compounds are destroyed. Emission stack testing has shown that the flare meets applicable ambient air standards, in accordance with NR 445, Wis. Adm. Code.

2. Groundwater

Residents living near the Site rely on groundwater for their drinking water and other domestic uses. Three nearby private wells have VOC impacts; two of the wells have point of entry treatment systems. The third well supplied a home and business. The well has been shut down and the home is unoccupied. The business receives bottled water. Thus, groundwater does not currently pose a public health hazard to nearby residences who obtain their drinking water from private wells. Residents using untreated contaminated groundwater could ingest contaminants when drinking water, inhale contamination released from the water during domestic uses (cooking, showering, etc.) and absorb contaminants through their skin while bathing and washing in contaminated water. The point-of-entry treatment units must be properly maintained to ensure removal of all contaminants from the water.

The standard used for selecting contaminants of concern for groundwater is the WDNR NR 140 Enforcement Standard (ES). This is a health based standard developed by the Wisconsin Division of Health (WDOH) and the WDNR to be protective of human health. The preventive action level (PAL) is used to identify potential contamination problems. An exceedance of the PAL is not necessarily an indication of short or long term health hazards.

Past Groundwater Exposure

In July 1986, the Stoppleworth home well was tested by WDNR for the presence of VOCs and none were detected. In August 1987, testing of the Stoppleworth, Schultz and Swanson wells by the landfill owner discovered the presence of VOCs above ES limits. A supply of bottled drinking water was provided to the three households in early 1988. It is estimated that eight people living in the three households were exposed to contaminated groundwater. Additionally, three employees at a seed business on the Swanson property may have been exposed to contaminated groundwater during their working hours. The exposure routes from the domestic use of contaminated groundwater includes ingestion, inhalation, and dermal adsorption.

In December 1989, the tenant occupying the Swanson home moved out and the well was shut down. The business at that location continues to receive bottled water. To eliminate all exposures to contaminated groundwater, the WDNR installed a granular activated carbon (GAC) POE water filtration system in May 1990 at the Stoppleworth and Schultz homes. Subsequent monitoring has shown the POE treatment system effectively removes all detectable VOCs. VOCs are still being detected in the unfiltered water. The POE treatment systems have become permanent water systems for these homes and the homeowners have been responsible for maintenance of the POE systems since summer, 1992. It is estimated that contaminant exposure took place for no more than four years (1986 to 1990). (See the Public Health Assessment for Refuse Hideaway.) Table 2 contains a summary of water quality data for the 3 private contaminated wells. A summary of the maximum concentrations detected follows:

Maximum Concentration of VOCs in Private Wells (ppb)

Compounds	Schultz	Stoppleworth	Swanson	PAL2	ES3
Chloroethane	3.2	19.5	ND 1	80	400
Dichlorodifluoro-methane	17.2	9.73	ND	200	100 0
1,1-Dichloroethane	6.9	4.9	ND	85	850
cis-1,2-Dichloroethene	33	30	ND	7	70
trans-1,2-Dichloroethene	47	21	1.5	20	100
1,2-Dichloropropane	1.34	<0.5	ND	0.5	5
Tetrachloroethene	284	30.1	3.5	0.5	5
1,1,1-Trichloroethane	1.5	2.2	ND	40	200
1,1,2-Trichloroethane	1.5	ND	ND	0.06	0.6
Trichloroethene	8.9	8.2	1.2	0.5	5
Trichlorofluoro-methane	20	16.8	2.3	698	349 0
Vinyl Chloride	6.1 5	5.5 5	ND	0.02	0.2

1 ND = Not Detected

2 PAL = Preventive Action Limit

3 ES = Enforcement Standard = Federal MCL for these compounds

4 Shaded = Exceedances of NR 140 ES

5 Vinyl Chloride was last detected 3/88

Future Potential Exposure

The two residences with GAC POE filter systems maintain those systems themselves. The systems must be properly maintained to avoid future potential exposure. If the third well is brought back into service, or, if a new well is drilled on the property, the pumped water will require adequate treatment to avoid exposure to contaminants.

Groundwater flow indicates that contaminated groundwater has the potential to flow through the wells in the Deer Run Heights neighborhood, located approximately one mile west-southwest of the Site. Selected wells in the Deer Run Heights neighborhood are sampled every 6 months in addition to semi-annual monitoring of 21 groundwater monitoring wells. This monitoring program will alert the WDNR to any changes in the location of groundwater contamination and provide advance warning of potential threats to nearby residents.

It is likely that new private homes and wells will be developed near the Site in the future. At this time (1995) there is a proposal to develop more than 200 private homes on the parcel of land adjacent to Refuse Hideaway to the east and northeast. Private wells would be placed

upgradient of the existing contamination, however, some of the proposed homes would be as close as 100 feet to the existing groundwater contamination. It is possible that additional development could take place on other nearby parcels.

Groundwater modeling performed in 1992 suggests that it is unlikely that the groundwater contamination will migrate to the Deer Run Heights neighborhood. However, inherent uncertainties of the model make it impossible to conclusively determine that the Deer Run Heights neighborhood will not be impacted. If the Site is not remediated and the contaminant plume continues moving away from the Site, contaminated groundwater might reach the Deer Run Heights neighborhood sometime in the future. There are an estimated 80 people living in 25 homes in the Deer Run Heights neighborhood. The closest home in the neighborhood is approximately 1,300 feet from the edge of the contaminant plume.

The highest detected concentrations of each contaminant detected in the groundwater were evaluated as a worst case future exposure scenario. Table 4 summarizes the compounds which have been detected above the ES and other contaminants of concern detected in groundwater and their highest concentrations. Benzene, chloroform, 1,2-DCA, cis-1,2-DCE, 1,2-dichloropropane, PCE, TCE, and vinyl chloride were all detected at concentrations exceeding the ES. Trans-1,2-DCE was evaluated because it was detected above NR 140 ES levels in pre-1989 samples. Bis(2-ethylhexyl)phthalate (an SVOC), heptachlor and 4,4'-DDT (pesticides) were the only detected compounds of their classes and were retained in the risk assessment.

The primary toxicity of the contaminants is related to their carcinogenic health effects. A water supply well installed directly in the most contaminated portion of the groundwater plume would experience this worst case scenario. Two known carcinogens, benzene and vinyl chloride, and several suspected carcinogens, chloroform, 1,2-DCA, 1,2-dichloropropane, PCE, TCE, bis(2-ethylhexyl)phthalate, heptachlor, and 4,4'-DDT have been detected above health based standards. Persons, who, over a lifetime, were to daily drink groundwater contaminated at the highest concentration levels detected in the plume may have an increased risk of getting cancer.

Non-carcinogenic health effects could be experienced from cis-1,2-Dichloroethene and trans-1,2-Dichloroethene, both of which have potential hepatic toxicity. Elevated iron and manganese levels associated with the landfill have no direct health effects but standards associated with these compounds are based on aesthetic qualities of water.

3. Surface Water/Sediment Pathway

Contaminants were detected in surface water in 1987 before the landfill clay cap was in place. Installation of the cap prevents surface water from becoming contaminated. Sampling of Black Earth Creek and the ditch south of the landfill found no VOCs in 1989. Surface water is not currently considered to be a pathway of concern. The sedimentation basin was drained and dredged in 1992, removing any accumulated sediment and eliminating sediment as a pathway of concern.

Currently, groundwater flow is such that groundwater contaminants are not discharging into Black Earth Creek. Without control, the groundwater plume has the potential to discharge contaminants into Black Earth Creek. If this occurred, the health effects would be the same as exposure to the contaminated groundwater.

B. Ecological Risk Assessment

Five VOCs were detected in surface water at the Site in 1987. These VOCs included: acetone, bromoform, 1,2-DCE, MEK, and toluene. Most of these chemicals are dangerous to aquatic life in high concentrations (percentage ranges) but do not concentrate in the food chain. Capping of the landfill in 1988 removed the potential for surface water to come in contact with waste materials. Surface water samples collected in the drainage ditch south of the landfill and in Black Earth Creek in 1989 detected no VOCs. The sedimentation basin was drained and dredged in 1992, eliminating it as a possible source of contaminants.

Therefore, the greatest potential for environmental effects would be from the release of contaminated groundwater to Black Earth Creek, the primary surface water body in the area. The current groundwater flow regime indicates that groundwater is not discharging into Black Earth Creek. The potential exists for a future discharge if groundwater flow gradients change. The compounds detected in groundwater that could have an affect on aquatic organisms include: benzene, bromomethane, chloroform, 1,2-DCA, cis-1,2-DCE, trans-1,2-DCE, and TCE. The acute and chronic ambient water quality criteria for all these compounds is one to two orders of magnitude above the maximum concentration found in the groundwater at RHL. These compounds do not concentrate in the food chain.

Based on the results of the environmental evaluation, the current risk posed to environmental receptors is low. The groundwater contaminant concentrations are not likely to have any acute environmental effects. Because of the carcinogenic nature of some of the contaminants of concern, and because the chronic effects of exposure to most of these compounds is not known, environmental receptors may be affected if the flow of impacted groundwater is not controlled.

There are no known endangered or threatened species or critical habitats on or near the Site. (Ref: WDNR Endangered Resources Letter, in Administrative Record)

C. Rationale for Further Action

Actual or threatened releases of hazardous substances from this Site, if not addressed by the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

VII. DESCRIPTION OF THE REMEDIAL ALTERNATIVES

A. Remedial Action Objectives

Remedial action objectives were developed for this Site to address the landfill as a long-term source of contamination, to address groundwater contamination, to ensure private water supplies are protected, to provide short and long-term protection of human health and the environment, and to meet applicable or relevant and appropriate requirements.

The main concern driving this cleanup is the existence of contaminants exceeding Federal MCLs and WDNR NR 140 ESs up to 3,800 feet downgradient of the landfill. These contaminants pose a future risk to existing and future private home wells in the area.

The Site specific remedial action objectives for this Site are:

Source Control RAOs

- Prevent direct contact with landfill contents;
- Minimize contaminant leaching to groundwater;
- Prevent the migration of landfill gas;
- Control surface water run-off and erosion; and,
- Attain compliance with all identified Federal and State ARARs.

Groundwater RAOs

- Attain the NR 140 PALs for all groundwater impacted by the RHL at and beyond the landfill boundary. NR 140 PALs are the most stringent of the groundwater standards that apply to this Site and are the primary goal on which this action is based. State groundwater goals are consistent with Section 300.430(a) (1) (iii) (F) which states

that U.S. EPA expects to return groundwater at the Site to beneficial use wherever practicable, within a time frame that is reasonable given particular circumstances of the Site. The contaminants of concern in the RHL groundwater are VOCs including: benzene, chloroform, 1,2-DCA, cis-1,2-DCE, 1,2-chloropropane, PCE, TCE and vinyl chloride. All of these contaminants of concern exceed NR 140, Wis. Adm. Code Enforcement Standards (equal to Federal MCLs) beyond the landfill boundary. Iron and manganese also exceed NR 140 Enforcement Standards, however, exceedances beyond the landfill boundary are primarily due to high concentrations occurring naturally in this area.

- Reduce the potential for exposure to contaminants in groundwater; and,
- Attain compliance with all identified Federal and State ARARs.

Water Supply RAOs

- Provide potable water to residences with contaminated water.

B. Development of Alternatives

Alternatives developed in the FS for the Remedy considered all prior remedial actions implemented by the owner and State of Wisconsin for this Site. These actions included: installation and maintenance of a final soil cover over the waste that meets all applicable State requirements for solid waste landfills; installation and maintenance of a gas and leachate extraction system on the landfill that meets all applicable State landfill and air requirements; installation and maintenance of point-of-entry (POE) GAC treatment systems on contaminated private home wells (homeowners have provided maintenance since 1992) and the installation and sampling of monitoring wells to identify and track movement of the groundwater contamination.

The remedial alternatives were assembled from applicable remedial technology options. A wide range of technologies and remedial options were reduced by evaluating them with respect to technical implementability, effectiveness, and cost. The alternatives surviving the initial screening were evaluated and compared with respect to the nine criteria required by the NCP. In addition to the remedial action alternatives, the NCP requires that a no-action alternative be considered for the Site. The no-action alternative serves primarily as a point of comparison for other alternatives.

The strategy used to develop alternatives was to provide general response actions (GRAs) that address each medium of interest in order to satisfy the RAOs. The GRAs are:

Source Control GRAs

In order to meet the RAOs for source control, the following are the proposed GRAs:

- No Action
- Limited Action (Fencing and Deed Restrictions)
- Improve the Existing Landfill Cap with a Flexible Membrane Liner (FML)

Groundwater GRAs

In order to prevent the migration of contaminated groundwater beyond the edge of waste and treat the groundwater to remove the contaminants found at the Site and specified in the RI, the following are the proposed GRAs:

- No Action
- Pump and Treat Groundwater
- In-Situ Treatment of Groundwater

Alternate Water Supply GRAs

In order to provide an alternate water supply for nearby residences, the following are the proposed GRAs:

- Provide Bottled Water
- Treat Groundwater with In-Home Water Treatment Systems
- Install a Community Well Off-Site
- Deepen the Existing Wells

These general response actions describe a variety of institutional and remedial actions intended to satisfy the Remedial Action Objectives. These general actions were screened based on effectiveness (degree to which the alternative protects human health and the environment and meets federal and state ARARs), implementability (degree to which an alternative is technically feasible), and cost (including construction and long-term operation and maintenance costs) prior to comparison to the NCP criteria.

1. Source Control Alternative Development

The U.S. EPA guidance for CERCLA municipal landfill Sites indicates that:

- Containment (capping) is generally the most practicable remedial alternative. Cap materials can range from soil cover to a multi-component impermeable cap.
- Treatment of soils and waste may be practicable for "hot spots".
- Extraction and treatment of contaminated groundwater and leachate may be required to control off-site migration of wastes.
- Constructing an active landfill gas collection and treatment system may be required to prevent off-site migration.

The RRL is not known to contain hot spots of hazardous waste. Therefore, removal and disposal of waste from the RHL was not considered further. Active gas and leachate extraction and treatment systems have been in place since August 1991. Therefore, technologies screened for source control actions included access restrictions and containment.

Two types of access restrictions used most often at landfills were evaluated: deed restrictions/zoning modifications and fencing. Deed restrictions and zoning modifications are intended to prevent or limit future Site use and development. The effectiveness of deed restrictions and zoning modifications depends on state and local laws, enforcement and maintenance.

The goal of a deed restriction and zoning modification at the RHL would be to protect the integrity of the cap. Fencing and/or gates physically limit access to the landfill. Signs warn potential trespassers that there may be a health threat associated with entering the Site.

Containment technologies include surface water controls and capping. The existing landfill cover at RHL complies with NR 504, Wis. Adm. Code and consequently, surface water controls and capping are currently in place at RHL. Consideration was given to the use of a partial geosynthetic cover at the landfill to further limit surface water percolation into the waste. Because no known hazardous waste has been disposed of in the landfill, a composite-barrier cap according to the Resource Conservation and Recovery Act (RCRA) is not required, but was used as a model for evaluating a composite cap at the Site.

The Source Control Alternatives developed for RHL include:

- Alternative A - No Action
- Alternative B - Limited Action
- Alternative C - Composite Cover

2. Groundwater Remedy Alternative Development

The purpose of the groundwater portion of the remedy is to return groundwater beyond the landfill boundary to its beneficial use, as an actual or potential groundwater source, within a reasonable period of time. Contaminated groundwater will be returned to its beneficial use when the concentrations of groundwater meet the groundwater cleanup standards found in NR 140, Wis. Adm. Code. The groundwater cleanup standards are the PALs. The groundwater cleanup standards are applicable requirements for the groundwater cleanup. These groundwater standards are listed in Table 5.

The location of the point of compliance for the groundwater cleanup standards is the waste boundary. Groundwater cleanup standards shall be attained throughout the contaminated plume (excluding the area underneath the landfilled waste). This area of attainment includes areas outside the property as well as the area within the property, up to the waste boundary (Figure 11)

Groundwater Extraction

Technologies screened to control groundwater included groundwater containment and groundwater recovery. Containment technologies usually involve the use of impermeable barriers and in-situ or ex-situ treatment in order to reduce the volume and concentration of contaminants. The depth of contaminants at RHL and the lack of an underlying impermeable zone precludes the use of these technologies.

Groundwater recovery is used to reduce contaminant mass and prevent migration by removing the groundwater from the aquifer. Two options were considered for RHL - groundwater interception trenches and groundwater extraction wells. Interception trenches are generally used where contamination is limited to 25 feet below the surface. Groundwater contamination extends approximately 100 feet beneath the surface adjacent to the landfill and is located in sandstone bedrock. Therefore, interception trenches can not be used at this Site.

Two options for groundwater extraction were evaluated for RHL:

- a. Limited Extraction and Treatment of Groundwater. This option includes extraction and treatment of groundwater near the landfill to capture the groundwater with contaminant concentrations in excess of 200 ppb while minimizing the amount of water requiring treatment and discharge. This technology will effectively remove the source of the contaminant plume because all areas with impacts below 200 ppb would be cut off from the landfill. Groundwater modeling contained in a Technical Memorandum titled "Numerical Evaluation and Design of a Well Field for Contaminant Capture and Ground-Water Control" was used to determine optimum well locations and discharge rates for this technology.

Additionally, 1992 modeling of the front edge of the plume indicates that the plume will reach equilibrium within five years due to natural attenuation processes and continue to degrade and decline after the source is removed. Cutting off the source of contamination would increase the ability of the natural attenuation processes to reduce VOC concentrations within the plume downgradient of the landfill.

- b. Extraction and Treatment of Groundwater at the Source and Throughout the Plume. The second extraction option evaluated pumping and treating groundwater from near the landfill as well as along the axis of the plume. It is estimated that groundwater extraction of the entire plume would likely generate 200 gallons per minute (gpm) of groundwater which would require treatment and subsequent discharge. Discharge options for 200 gpm are extremely limited. As discussed later, the primary difficulty at RHL is

lack of discharge options for treated groundwater. The surface water bodies in the area do not have the assimilative capacity to handle a 200 gpm flow. An infiltration gallery would require many acres of premium crop land. Finally, multiple injection wells (at least 8 or more) would be required and controlling the injected water is not likely feasible. Preliminary cost estimates for this option include: capital costs - \$1,450,000; annual O&M - \$340,000 with a 20 year present worth of \$5,800,000 (cost error estimates are +100% and -60%). Estimated cleanup time for pumping and treating the whole plume is 10 to 20 years verses 20 to 40 years for pumping at the landfill source, assuming a feasible discharge location existed. Therefore, extraction, treatment and discharge of 200 gpm water was determined to not be a feasible option because of lack of a discharge alternative. This option was not carried through the nine criteria evaluation.

Groundwater Treatment

Two major groundwater treatment options were considered - ex-situ treatment and in-situ treatment. Contaminated water extracted from the plume would be treated above ground in a "treatment train". In-situ treatment is an innovative technology and is considered as part of the overall treatment train, not as a stand alone option.

1. Ex-situ treatment options. These options include treatment for organics and inorganics. Treatment for organic contaminants includes carbon adsorption for providing a high level of removal of "non-specific" organic materials and air stripping for treating VOCs. These two technologies may be used together for the greatest efficiency of organic contaminant removal. Carbon absorption requires disposal or regeneration of the carbon. Biological treatment was also evaluated. Biological treatment requires sufficient organic material to sustain treatment and may be less appropriate for dilute groundwater streams. All contaminants confirmed at the landfill can be successfully treated with carbon and/or air stripping, so biological treatment was not retained for evaluation.

Options evaluated for treating inorganic compounds include chemical precipitation and ion exchange. Chemical precipitation converts a wide variety of metals in the groundwater from a soluble to an insoluble form. This process generates sludges which require subsequent disposal as either a solid or hazardous waste, depending on the chemical makeup of the sludge. Ion exchange removes dilute concentrations of metals from the water stream and can be used to "polish" the water after chemical precipitation. Regeneration of ion exchange resins usually produces a metal concentrate that requires disposal.

2. In-situ treatment options. In-situ groundwater treatment technologies are considered innovative by EPA. Technologies considered include air sparging with vapor recovery, in-situ bioremediation and in-situ chemical oxidation. The depths of groundwater contamination near the Site (greater than 100 feet render air sparging infeasible. The main constituent in the groundwater, PCE, does not lend itself to treatment by chemical oxidation, so this option was not carried through the evaluation. In-situ bioremediation includes aerobic biodegradation and co-metabolism. Ideally, in-situ bioremediation stimulates subsurface microorganisms to degrade contaminants within the aquifer to carbon dioxide and water. In-situ bioremediation is carried through the evaluation for RHL. However, the specific techniques for stimulating native microorganisms to degrade these contaminants will have to be determined by bench scale studies.

Groundwater Discharge

Groundwater which is removed from an aquifer and treated to remove contaminants requires discharge. Methods typically used to discharge treated groundwater include discharge to: surface waters, Publically Owned Treatment Works (POTW), infiltration galleries, injection wells, or use of water for irrigation purposes.

1. Discharge to Surface Waters. The nearest surface water body is Black Earth Creek, a Class I trout stream classified as an Outstanding Resource Water (ORW) by the WDNR. Water could also be discharged to the headwaters of the adjoining water shed, Pheasant

Branch Creek. Preliminarily identified water quality based discharge limits could be met through treatment. Four potential surface water discharge locations exist (see Figure 12):

- a. Black Earth Creek via Intermittent Drainage Ditch. The ditch is located 200 feet from the southeast corner of the landfill.
 - b. Black Earth Creek at Twin Valley Road. This location is 2/3 mile southwest of the landfill. The creek flows year round at this location.
 - c. Black Earth Creek at Cross Plains. This location is approximately 5 miles west of the landfill in the City of Cross Plains. Black Earth Creek is classified as an "exceptional" resource water (ERW) at this location.
 - d. East Fork of Pheasant Branch Creek. This is an inter-basin transfer of water and would require lifting the water 220 feet and conveying it 1 mile north of the landfill. Pheasant Branch Creek is classified as a "warm water fishery".
2. Discharge to a POTW. The nearest POTW connection is 2 miles east of RHL in the City of Middleton. The Madison Metropolitan Sewerage District (MMSD) serves the cities of Madison and Middleton. Discharge to the POTW would require that MMSD install a conveyance system to the landfill. MMSD has indicated it does not anticipate construction of such a system and second parties are not allowed to build conveyance systems to MMSD.
 3. Discharge to an Infiltration Gallery. An infiltration gallery would allow treated water to percolate through the soil, recharging the aquifer. U.S. EPA requires that the design percolation rate be 4% of the minimum soil permeability. Therefore, the area of the infiltration gallery would be approximately 76,400 square feet for a sand Site.
 4. Reinjection to the Aquifer via Injection Wells. Treated water injected into the aquifer upgradient of the plume would help increase the rate of remediation by flushing the area with clean water and stimulating in-situ degradation through the addition of dissolved oxygen to the aquifer.
 5. Use of Treated Water for Irrigation Purposes. Treated groundwater could be used to irrigate agricultural areas in the vicinity of the Site. This option can only be used on a seasonal basis and does not provide for on-going disposal of the treated water. It is not carried through the nine criteria. However, if an irrigation user wanted water seasonally, was willing to construct and maintain the conveyance system and could obtain a Wisconsin Pollution Discharge Elimination System (WPDES) permit, the water could be used for irrigation purposes.

The Groundwater Extraction and Treatment Alternatives developed for RHL include:

- | | |
|-----------------|--------------------------------------------------------------------------------------------|
| Alternative A - | No Action |
| Alternative D - | Groundwater Extraction and Treatment with Discharge to Surface Waters |
| Alternative E - | Groundwater Extraction and Treatment with Discharge to an Infiltration Gallery |
| Alternative F - | Groundwater Extraction and Treatment with Reinjection for Enhanced In-Situ Bioremediation. |

3. Water Supply Alternative Development

While the groundwater contamination is not expected to move beyond the presently defined plume boundaries, a risk to users of private wells does exist. Therefore, the following alternate water supply options were considered: bottled water, deepening existing wells,

individual point-of-entry (POE) treatment units, and installation of an off-site community well.

Bottled water is generally a short-term action that does not address non-ingestion impacts of contaminated water (inhalation and dermal contact). Therefore, this was not considered further.

Deepening existing wells has been tried by the WDNR at the Schultz home. A water supply well was drilled to 448 feet below ground and cased to 359 feet. VOC impacts were detected in two water samples collected after well development. Based on this experience, deeper wells do not appear to be a viable option at this Site.

POE systems have been installed in two homes ½ mile southwest of RHL and have removed all VOCs from the home water for 5 years. A community water supply well could be installed several thousand feet down gradient of the plume and a water distribution system could be provided to residences most likely to be affected (estimated at 25 homes).

The Water Supply Alternatives developed for RHL include:

- Alternative A - No Action
- Alternative G - Supply Individual In-home Water Treatment Units
- Alternative H - Construct a Community Well

C. Alternatives

A complete description of the various alternatives is provided in the Feasibility Study. A brief narrative description of each alternative is provided below:

1. Source Control Alternatives

Alternative A: No Action

The No Action alternative is developed to act as a baseline to compare against all other alternatives. This alternative consists of operation and maintenance of all actions currently implemented, including, the gas/leachate extraction system, maintenance of the soil cap and long-term monitoring for VOCs at 21 existing groundwater monitoring wells and 12 private wells. This action meets all required State and Federal standards for closed landfills. This alternative does not, by itself, meet NR 140 groundwater standards. No capital costs are involved in this alternative. Annual O&M cost is \$100,000 with a 30 year present worth cost of \$1,376,000.

An analysis of the effectiveness of the existing clay cap was made by using the U.S. EPA HELP model to estimate the percolation rate through the cap. This analysis showed that 1.1 inches/year, or 670,000 gallons of water per year move through the landfill cap. The average leachate extraction rate per year is approximately 187,000 gallons, therefore 483,000 gallons of leachate currently has the potential to percolate to the groundwater each year.

Based on 1988 data, the average VOCs in leachate is about 500 ppb. It was assumed that the average quantity of VOCs which percolates to the groundwater is a maximum of approximately:

483,000 gallons/year x 500 ppb VOCs = 0.2 gallons/year VOCs

Over time, the concentration of VOCs in the leachate should reduce as VOCs are flushed from the waste and removed through the gas and leachate extraction system.

Alternative B: Limited Action (Selected Alternative for Source Control)

This includes all actions under Alternative A. This alternative adds deed restrictions and zoning modifications to protect the integrity of the landfill cap into the future. A fence and gate have already been constructed along the southern edge of the Site at the access road to limit access. Topography (steep vertical rock walls and thick woods) restricts access to the landfill from the north, west and east. Signs would be posted along the property boundaries at regular intervals to warn potential trespassers of the potential risk of entering the Site. This alternative does not, by itself, meet NR 140 groundwater standards. The capital cost of this option is \$7,000 with an annual O&M cost of \$100,000. The 30 year present worth cost is \$1,383,000.

Alternative C: Composite Cover

This alternative involves the construction of a composite cover over the flatter top slope areas of the landfill (approximately 20 acres). The existing vegetation would be removed and the topsoil and general soil would be removed and stockpiled. The 2 1/4 feet of compacted clay would remain in place and a geosynthetic liner and drainage layer would be placed over the clay. The general soils and topsoil would be replaced and graded and the Site would be revegetated. The final top cover of the landfill would consist of (from top to bottom):

- A 6 inch topsoil layer, seeded and fertilized to sustain a dense vegetative growth of native plants;
- A minimum 18 to 30 inch thick general soil layer to act as frost protection and a rooting zone layer;
- A drainage layer of either 6 inches of sand or a geonet/geofabric drainage layer;
- A 40 or 60 mil thick low density polyethylene (LDPE) geomembrane; and
- The existing 2 ½ foot thick low permeability clay layer, constructed in 1988 in accordance with NR 504.07(4), Wis. Adm. Code.

The basic benefit of the composite cover would be to reduce leachate production and the subsequent release of contaminants to the groundwater. U.S. EPA's HELP model was used to estimate a percolation rate of 0.01 inches/year, or 9,300 gallons of water entering the waste each year through the composite cover. Because of the low leachate generation rates, it can be expected that leachate pumping would eventually be eliminated.

Alternative C would result in significantly less leachate generation when compared with the other source control options. Alternative C would result in reduced leachate percolation to groundwater and ultimately lower levels of aquifer contamination. However, it is unlikely that NR 140 PAL levels would be met by this alternative alone because VOCs will continue to enter the groundwater even with reduced leachate volumes percolating to the groundwater. The mass of contaminants in the waste does not change under any source control alternative, therefore, the total release of contaminants through time can be expected to be the same for all source control alternatives. Alternative C would have the lowest release rate, thus maintaining the smallest plume volume, but may result in releases for the longest period of time (that is, contaminants flush from the landfill more slowly for a longer time), thus resulting in a longer plume persistence than any of the other source control alternatives.

Alternative C, by itself, does not meet NR 140 groundwater standards. Capital cost of this option is \$2,876,000 with an annual O&M cost of \$75,000. The 30 year present worth cost is \$3,908,000.

All Source Control Alternatives result in the waste mass being left in place. Therefore, EPA and WDNR will review the data at 5 year increments to determine if the remedy is still protective, or whether additional Source Control measures need to be taken.

2. Groundwater Extraction and Treatment Alternatives

Alternative A: No Action

Under Alternative A, no additional corrective action besides that of Source Control Alternative B would be taken at the Site to address groundwater contamination. This would result in a continued off-site migration of existing contaminants in the groundwater. This remedy would allow the Site to remain as it exists today. Therefore, contamination within the aquifer would be addressed primarily through natural attenuation processes such as dilution, dispersion, and degradation. These processes are expected to cause the plume to stop migrating further from the landfill within a period of five years from 1991, when the information for the contaminant transport model was collected.

The No Action Alternative does not meet the standard of providing protection of human health and the environment because the landfill is likely to leak contaminants for a very long period of time and the only protections under the No Action Alternative are institutional controls (e.g., water supply wells can not be placed within 1,200 feet of a landfill) or addition of point-of-entry treatment systems to contaminated private wells. Both of these protections are subject to failure. Alternative A does not meet the Remedial Action Objective (RAO) of restoration of groundwater quality to WDNR NR 140 cleanup standards.

There is no cost associated with the No Action Alternative.

Alternative D: Groundwater Extraction and Treatment with Discharge to Surface Water

A single groundwater extraction and treatment approach has been developed for RHL. The following description of this approach applies to extraction and treatment of Alternatives D, E and F. The difference in the alternatives involves groundwater discharge options.

Groundwater Extraction Component

Groundwater extraction scenarios were modeled using the U.S. Geological Survey's MODFLOW, a three-dimensional model that simulates drawdowns using the finite difference method. PATH3D was used in conjunction with MODFLOW to perform capture zone analysis and particle tracking calculations. Because groundwater discharge options are quite limited at RHL, the goal of the modeling effort was to define the groundwater pumping scenario that effectively captures the groundwater contamination emanating from the landfill (greater than 200 ppb total VOCs) while minimizing the volume of water requiring treatment and discharge.

Based on the results of the modeling, four recovery wells would be installed on the south and west sides of the landfill. The wells would be installed at various depths (from 29 feet below the water table to 87 feet below the water table) and would pump between 10 and 15 gallons per minute (gpm) to achieve optimal capture of the highest observed contaminant concentrations (greater than 200 ppb total VOCs, Figure 13). Total pumping rate would be 45 gpm. Pumping 45 gpm of groundwater with an average concentration of 200 ppb VOCs will remove 5 gallons of VOCs per year from the groundwater. As stated above, it is estimated that the landfill contributes 0.2 gallons of VOCs to the aquifer yearly. Therefore, 25 times more contaminant will be removed each year than leaches to the groundwater. Over time, the amount of VOCs leaching from the waste to the groundwater should reduce (as the mass of VOCs in the waste is reduced) and the volume of VOCs removed by the extraction wells will reduce as the mass of contaminants in the aquifer reduces.

The extraction wells will provide hydraulic control of groundwater at the waste boundary within a matter of days of beginning to extract groundwater. Extraction of impacted groundwater currently underlying the landfill would be achieved within approximately 5 years. Additional flushing (by continued groundwater extraction) of non-impacted water would be required to remove VOCs from the aquifer beneath the landfill to return the groundwater to NR 140 standards. Based on aquifer conditions and the fact that the aquifer beneath the landfill is the most highly contaminated area of groundwater, 2 to 4 pore volumes are estimated to be required to flush VOCs from the aquifer. It is estimated that the landfill's

contribution of contaminants to the groundwater plume would end after 15 to 20 years of pumping. This assumes that significant leaching of VOCs from the landfill ceases after 15 to 20 years. It is impossible to know when VOCs will be effectively flushed from the waste mass, therefore pumping of wells near the landfill boundary may be required for a considerably longer period of time than represented by the 15 to 20 year estimate.

With implementation of groundwater extraction, the source of further groundwater contamination will be eliminated and natural processes will begin to eliminate the plume extending downgradient of the landfill. As non-impacted water is flushed through the aquifer, contaminants will be subject to natural attenuation processes of dilution, dispersion and degradation. Based on travel time for contaminant movement from the landfill to private wells and groundwater model estimates, it is estimated that one flushing of the aquifer between the landfill and the edge of the plume will take 20 years. It is estimated that it will take one to two flushings of the aquifer to achieve groundwater standards downgradient of the landfill, therefore cleanup time is estimated to be 20 to 40 years.

Groundwater Treatment Component

To define a treatment system, it is necessary to know both the influence concentrations and equal to the worst case conditions measured at monitoring wells at the Site. The discharge requirements vary depending on the discharge method and location. The preliminary water-quality based effluent standards have been developed by the WDNR. Table 6 summarizes the highest measured influent groundwater concentrations and the treatment goals based on various discharge alternatives. The treatment system has been designed based on the highest estimated influent concentrations. Because it is unlikely that actual influent concentrations will be as high as estimated, actual treatment system design should be modified during Remedial Design after aquifer testing and groundwater analysis is completed.

Development of the treatment system began with the preliminary discharge standards for surface water and NR 140 PALs for groundwater. Best Available Technology (BAT; 40CFR125 and NR 220, Wis. Adm. Code) requirements were the assessed. Figures 14 and 15 present the conceptual flow diagrams of the proposed groundwater treatment system of each potential discharge location. Both treatment approaches include:

- A flow equalization tank to provide uniform quality and quantity of groundwater prior to treatment;
- A chemical precipitation tank would be used for precipitation of inorganic compounds. Bench scale treatability tests are required to determine the chemical additives needed. Possible additives include: hydroxides, sulfides, ferrous sulfate, inorganic sulfides, organic sulfur precipitants, and other metal precipitants. Chemical precipitation generates sludge that requires disposal as either a solid waste or hazardous waste, depending on the chemical analysis of the sludge.
- A flocculation tank and a clarifier would be added to remove metal precipitates that did not settle in the chemical precipitation tank.
- An air stripping tower would be used to remove the strippable VOCs from the water stream. According to the FS, the projected effluent concentrations of VOCs from the stripper would be at concentrations less than one part per billion. Based on a water flow rate of 45 gpm, an emission rate of 0.12 pounds per hour is expected. Vapor control equipment is not expected to be required.
- Air stripping will treat all VOCs detected at RHL except for bromomethane. Bromomethane was detected only during the January 1991 sampling period and has not been confirmed in any monitoring wells. Therefore, bromomethane is not likely to be a concern. If it is detected during future studies, additional treatment, such as biological or chemical oxidation will need to be evaluated.

- A carbon absorption unit is BAT for removal of the detected SVOCs and pesticides. These compounds and projected influent concentrations are: 4,4'-DDT at 0.075 ppb, bis(2-ethylhexyl)phthalate at 95 ppb, and heptachlor at 0.012 ppb. An 800 lb. liquid-phase carbon absorption system is expected to not require change out more frequently than once a year. Carbon absorption may not be required if the influent groundwater in the proposed treatment system contains non-detectable SVOCs and pesticides.
- Ion exchange would be added as a metal polishing unit for discharges to the ORW segment of Black Earth Creek (Alternatives D1 and D2) and for groundwater discharges (Alternatives E and F). Other approaches include sulfide precipitation or other polishing steps to achieve the low metal concentrations of the ORW discharge.

Testing of groundwater has not been done for conventional pollutants (e.g., BOD5, chloride, phosphates, nitrates and nitrites). Possible treatments options, such as reverse osmosis, for these constituents have not been included in the cost comparisons of the alternatives. In addition, a heat exchanger and pH adjustment may be necessary to adjust the temperature and pH of the final effluent stream, if the effluent is discharged to the ORW segment of Black Earth Creek.

Alternative D1: Groundwater Extraction and Treatment with Discharge to Black Earth Creek via a Drainage Ditch at SE Corner of Landfill

An agricultural ditch system in the upper Black Earth Creek Valley provides drainage to surrounding farm fields and constitutes the headwaters of Black Earth Creek (Figure 12). The drainage ditch begins at the southeast corner of the RHL property. A 200 foot discharge pipe would be built from the treatment plant at the landfill to the drainage ditch. Flow in the ditch is intermittent so discharge of treated groundwater at this point would constitute almost 100 percent of the flow in the ditch.

Black Earth Creek is a Class I trout stream, a cold water fishery and is classified as an Outstanding Resource Water (ORW) by the WDNR. As an ORW, the creek is given the highest protection by the State. The creek is assumed to have no assimilative capacity for contaminants. Any effluent discharged to an ORW must meet all background water quality conditions. In 1947 the WDNR established Black Earth Creek as a Habitat Demonstration Area (now called the Black Earth Creek Fishery Area). It was chosen as a priority watershed in 1987. Cold water, naturally reproducing trout streams are very rare in southern Wisconsin. Black Earth Creek is a regionally and nationally important resource and was named one of the top 100 trout streams in the country by Trout Unlimited. Black Earth Creek is a fragile resource that is very sensitive to temperature fluctuations. Black Earth Creek experiences periods when temperatures exceed lethal limits for brown trout during the summer. Trout reproduce during the late fall and winter and a discharge with a different temperature regime could impair reproduction. In addition, a change in water volume could adversely affect the fishery of Black Earth Creek. (Ref: July 8, 1994 WDNR memo from Scot Stewart to Steve Fix.)

A drainage district has been established in the upper Black Earth Creek Valley for maintenance of the agricultural drainage ditch system. The upper valley is prone to flooding. The increased flows caused by a discharge to the ditch system would likely exacerbate the high water conditions during wet periods of the year. (Ref: Telephone conversation of T. Evanson with Richard Heinrich, Drainage District President) Therefore, any discharge proposed for the upper Black Earth Creek would require a hydrologic and ecological evaluation to determine what impact the discharge would have on the stream and the surrounding land. Any impact whatever would likely result in the WDNR denying approval for discharge to the ditch system. Under Superfund, this would be an "on-site" action and no administrative permits are required, however compliance with the substantive portions of the permit is required.

Capital cost for Alternative D1 is \$706,000 with an annual O&M of \$164,000 and a 30 year present worth of \$2,965,000.

Alternative D2: Groundwater Extraction and Treatment with Discharge to Black Earth Creek at Its Intersection with Twin Valley Road

This proposed discharge is approximately two thirds of a mile southwest of the landfill (Figure 12). This location is within the Black Earth Creek drainage district and is included in the ORW classification. Here, discharge of the treated groundwater would comprise approximately 10% of the creek's flow. All other issues described in Alternative D1, namely water quality, water temperature, water volume and overall ecological environment concerns apply to this discharge location. In-addition, it is likely that a discharge at this distance from the landfill would be considered "off-site" and would require a Wisconsin Pollution Discharge Elimination System (WPDES) permit. Construction of a discharge pipe would disturb more land and require more easements than Alternative D1. Estimated costs are: capital costs - \$903,000; O&M \$164,000; and a present worth cost of \$3,160,000.

Alternative D3: Groundwater Extraction and Treatment with Discharge to Black Earth Creek at Cross Plains

This alternative involves construction of a discharge pipe to Black Earth Creek downstream of the Cross Plains POTW, approximately 5 miles west of the landfill (Figure 12). Below the Cross Plains POTW, WDNR's classification of Black Earth Creek changes to an Exceptional Resource Water (ERW). Very stringent water quality restrictions also apply to ERWs, although some assimilative capacity for contaminants is allowed. The treatment scheme for this discharge would likely not require an ion exchange polishing step. In addition, the treated groundwater discharged at this point would make up much less of the total flow of the creek than under Alternatives D1 and D2. Concerns for impacts on water temperature and flow are lessened compared to the ORW discharges of Alternatives D1 and D2.

Construction of a discharge line over 5 miles in length would be difficult to implement with considerable disturbance of land and many easements required. This action would be considered "off-site" and would require a WPDES permit from the WDNR. Capital costs are estimated to be \$1,474,000 with O&M of \$162,000 and a present 30 year worth of \$3,704,000.

Alternative D4: Groundwater Extraction and Treatment with Discharge to the East Fork of Pheasant Branch Creek

A separate watershed exists to the north of RHL which drains to the East Fork of Pheasant Branch Creek. For this interbasin transfer, water would need to be conveyed a distance of approximately one mile with an elevation rise of 220 feet. Discharge would be to an intermittent stream and the treated groundwater discharge would make up approximately 100% of the creek flow at the discharge point. Pheasant Branch Creek is classified as a Warm Water Fishery, and as such, does not merit the-same water quality protection as an ORW or ERW classification. However, because the discharge would make up 100% of the flow, the projected water quality based effluent limits from WDNR are somewhat more stringent than those of the ERW segment of Black Earth Creek. The water treatment scheme developed for the ERW would be used for the East Fork of Pheasant Branch Creek.

This option would likely be considered an "off-site" action and would require a WPDES permit. Considerable disturbance of land and several easements would be required to construct the discharge line. The estimated capital costs are \$750,000 with an annual O&M of \$162,000. The 30 year present worth costs are \$2,980,000.

Alternative E: Groundwater Extraction and Treatment with Discharge to an Infiltration Gallery

Treated groundwater would be discharged to an infiltration gallery. The treatment scheme would be the same as that proposed for the ORW discharges. For cost estimation purposes, it was assumed the infiltration gallery would be 6 feet deep, 275 feet wide by 275 feet long, with a surface area of 76,000 square feet. Groundwater would be pumped into the infiltration gallery and discharge to gravel-filled trenches where the treated water would infiltrate down to the shallow aquifer. The infiltration gallery would be surrounded by a clay berm to minimize run-on of surface water.

The infiltration gallery must be placed in suitable permeable soils for proper discharge of water. Figure 16 shows those areas that may be suitable. Most of the suitable soils are along Black Earth Creek. Any hydrologic connection of the infiltration gallery to Black Earth Creek would have to be investigated to ensure that the creek would not be affected by the discharge. For cost estimation, it is anticipated that the infiltration gallery would be 3,500 feet from the landfill. Construction would require land disturbance, easements and likely land purchase for the gallery. Capital costs are estimated to be \$1,116,000 with annual O&M of \$154,000 and a 30 year present worth of \$3,236,000.

Alternative F: Groundwater Extraction and Treatment with Reinjection to Enhance In-Situ Bioremediation (Selected Alternative)

In Alternative F extracted groundwater would be treated with the treatment system as proposed for the ORW discharge locations. Treated groundwater would be piped to two 55 feet deep injection wells located approximately 400 feet east of the landfill (1,600 feet upgradient of the proposed groundwater extraction wells, Figure 17). Groundwater injection is essentially the reverse process of groundwater extraction - groundwater would be pumped into the wells and flow into the aquifer through the screened zone of the wells. Periodic treatment (usually acid treatment) of the injection wells would be required to remove scale and metal precipitates which may clog the injection well screens.

The treated groundwater will be oxygenated due to the air stripping process and injecting this water would oxygenate the aquifer. Oxygen should stimulate naturally-occurring microorganisms in the aquifer to degrade contaminants within the aquifer. Only some of the contaminants are subject to degradation through oxygenation alone (such as benzene and vinyl chloride). The chlorinated compounds (particularly PCE and TCE) would likely require other additives, such as co-metabolites, to stimulate their natural degradation. Treatability studies to evaluate the addition of other materials (besides oxygen) to the injected groundwater would need to be conducted during Remedial Design. Additionally, injection of treated groundwater upgradient of the groundwater plume would help increase the rate of remediation by flushing the aquifer with clean water.

Alternative F will likely result in a quicker aquifer cleanup time than Alternatives D and E. However, the time reduction can not be quantified at this time. The total time savings over Alternatives D and E could range from months to a few years.

Groundwater modeling indicates that groundwater flow during reinjection should remain essentially the same as at present. The modeling indicates that the injected water should help remediate the contamination beneath the landfill as well as contamination in the plume that has moved southwest of the landfill. It is not expected that reinjection will have any impact on Black Earth Creek or on home wells in the area. Land disturbance will result during construction of the discharge line and injection wells. An easement on the property adjoining RHL would be necessary. Estimated capital costs for Alternative F are \$576,000 with an annual O&M of \$157,000 and a 30 year present worth of \$2,737,000.

3. Water Supply Alternatives

Water supply alternatives are included in addition to Source Control and Groundwater Extraction and Treatment Alternatives in the event the contaminant plume contaminates or imminently threatens private residential wells in the future.

Definition of a "contaminated or imminently threatened" private well: To receive an alternate water supply system, a home well must have confirmation (at least 2 sampling rounds) of contaminants originating from the RHL that are equal to or greater than the Federal MCLs or WDNR NR 140 Enforcement Standards. A well will be considered "imminently threatened" and will receive an alternate water supply if neighboring water supply wells or groundwater monitoring wells indicate that contamination is likely to extend to the "imminently threatened" well and to exceed the Federal MCL or NR 140 ES.

Likely area to be served: It is projected that 25 existing residences located in a one-mile radius downgradient of the existing groundwater plume may require installation and operation of an alternative water supply. Projected costs for supplying alternative water are based on an estimate of 25 homes. However, a proposed subdivision northeast (upgradient) of the landfill has the potential to require alternative water supplies. This development will consist of 200+ residential homes, with one water supply well per every 4 homes. In addition, it is anticipated that a golf course will be built in the midst of the development and a 500 gpm high capacity well is proposed to provide water to the golf course. It is possible that home wells could become contaminated by being placed too close to the existing plume or by pumping the high capacity well and drawing the contamination upgradient of its present location.

Alternative G: Supply Individual Water Treatment Units (Selected Alternative)

This alternative involves the installation and operation of granular activated carbon (GAC) point-of-entry (POE) treatment systems at each residence with a groundwater supply well that is contaminated or imminently threatened with contamination. The POE systems would treat the entire household water supply prior to distribution throughout the residence. For the protection of human health, the POE systems would treat the groundwater to no detect for VOCs. GAC POE units are currently in use at two homes whose water wells have been contaminated with VOCs from the Refuse Hideaway Landfill. These units have been very effective in removing the contaminants and providing a reliable supply of potable water. The units can be installed one at a time and are readily available. The drawback to POE systems is that they must be maintained to be effective. The homeowners at the two residences using POE systems near RHL are responsible for maintenance of the POE units in their homes.

It is expected that at least one POE system would be installed at the Randall Swanson property (known as Sunnyside Seed Farm) south of U.S. Highway 14, approximately 3,800 feet southwest of the landfill. The home on this property is not currently in use and the driven-point well supplying the home and business has been shut down. The Swanson well does not meet State well construction requirements. However, if the well is upgraded or if a complying well is constructed on the property, a POE treatment system will be required to ensure clean water is delivered to the residence. It is expected that a 35 foot deep well with a POE system would meet the requirements of the Swanson house. Given the State's experience with trying to replace the Schultz well, a deep well would not likely provide clean water at this location.

As mentioned above, no more than 25 home wells located southwest of the landfill in Deer Run Heights and near U.S. Highway 14 and Rocky Dell Road are expected to need replacement water supplies. It is possible that the well supplying water to two homes at Summer's Tree Farm northwest of the landfill may require a POE system if that well becomes contaminated as a result of radial groundwater flow near the landfill. An unknown number of homes in the proposed Hidden Oaks subdivision northeast of the landfill could possibly require alternative water supplies.

The estimated capital cost for 25 home POE systems is \$220,000 with an annual O&M cost of \$62,500. The 30 year present worth cost is \$1,080,000.

Alternative H: Construction of a Community Well

This Alternative involves construction and operation of a community water supply well located several thousand feet downgradient of the impacted groundwater, beyond the anticipated future reach of the contaminant plume. The well would be constructed southwest of the landfill and would be screened at greater than 150 feet below ground surface. A 50,000 gallon elevated water tank would be used to store the pumped water and water would be distributed to each affected residence via a water main with an approximate length of 10,000 feet. This Alternative would be highly reliable and does not depend upon home owner's maintenance for effectiveness. It is not cost effective to construct a community water supply well to serve a few homes. However, a community well should be constructed if the number of private home wells requiring replacement makes it cost effective to use a community well rather than

point-of-entry systems. The estimated cost of Alternative H is: capital cost, \$783,000; annual O&M costs, \$50,000; and a 30 year present worth of \$1,471,000.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A. Introduction

U.S. EPA. has established in the NCP nine criteria that balance health, technical, and cost considerations to determine the most appropriate remedial alternative. The criteria are designed to select a remedy that will be protective of human health and the environment, attain ARARS, utilize permanent solutions and treatment technologies to the maximum extent practicable, and to be cost effective. The relative performance of each of the remedial alternatives listed above has been evaluated using the nine criteria set forth in the NCP at 40 CFR 300.430(e) (9) (iii) as the basis of comparison. These nine criteria are summarized as follows:

THRESHOLD CRITERIA - The selected remedy must meet the threshold criteria.

1. Overall Protection of Human Health and the Environment

A remedy must provide adequate protection and describe how risks are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

2. Compliance with Applicable or Relevant and Appropriate Requirements

A remedy must meet all applicable or relevant and requirements of federal/state laws. If not, a waiver may apply.

PRIMARY BALANCING CRITERIA are used to compare the effectiveness of the remedies.

3. Long-term Effectiveness and Permanence

Once clean up goals have been met, this refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility or Volume Through Treatment

The purpose of this criterion is to anticipate the performance of the treatment technologies that may be employed.

5. Short-term Effectiveness

This refers to how fast a remedy achieves protection. Also, it weighs potential adverse impacts on human health and the environment during the construction and implementation period.

6. Implementability

This criterion requires consideration of the technical and administrative feasibility of a remedy, including whether needed services and materials are available.

7. Cost

Capital, operation and maintenance, and 30 year present worth costs are addressed.

MODIFYING CRITERIA deal with support agency and community response to the alternatives.

8. Support Agency Acceptance

After review of the Focused Feasibility Study and the Proposed Plan, support agency's concurrence or objections are taken into consideration.

9. Community Acceptance

This criterion summarizes the public's response to the alternative remedies after the public comment period. The comments from the public on the Proposed Plan for this Site are addressed in the Responsiveness Summary attached to this ROD.

B. Evaluation of the Remedial Alternatives

THRESHOLD CRITERIA

The threshold criteria are CERCLA statutory requirements that must be satisfied by any alternative in order for it to be eligible for selection as a CERCLA-quality remedy. These two criteria are discussed below:

1. Overall Protection of Human Health and the Environment

Source Control Alternatives: All three landfill cap alternatives, including the No Action Alternative, prevent direct contact with waste and address air and surface water media. All source control alternatives, including No Action, include: continued operation and maintenance of the existing landfill gas collection system and would prevent migration of landfill gas from the Site; operation and maintenance of the leachate extraction system with off-site treatment and disposal; inspection and maintenance of the existing cap to control surface water run-off and erosion; and testing of existing groundwater monitoring wells and private wells.

Alternatives B and C include placement of a deed restriction/zoning modification and warning signs around the disposal area and are therefore more protective than Alternative A at protecting the landfill integrity into the future.

The expected percolation rate through the geosynthetic membrane cap of Alternative C is 0.01 inches/year versus 1.1 inches/year for the existing clay cap specified in Alternatives A and B. Therefore, Alternative C provides the greatest reduction of infiltration of leachate to groundwater. A reduction of the contributions of leachate to groundwater would result in a decrease in contaminant concentration within the groundwater plume and likely a reduction in plume extent with time. The reduction in groundwater contaminant concentration and plume extent resulting from Alternative C would be more protective of human health and the environment than either Alternatives A or B. However, Alternative C by itself will not remove existing contamination from the groundwater nor restore groundwater to NR 140 standards beyond the waste boundary. Alternative B, in combination with a groundwater extraction alternative would be more protective than any source control option by itself. Alternative C, in combination with a groundwater extraction alternative would be as protective as Alternative B in combination with groundwater extraction/treatment.

Groundwater Extraction and Treatment Alternatives

The qualitative risk assessment indicates that there is a future risk to human health and the environment from contaminated groundwater from the Refuse Hideaway Landfill. Three private water supply wells are currently impacted by contaminants emanating from RHL. Two of these wells have point-of-entry (POE) treatment systems installed and are not coming in contact with contaminants. The third home/business is not currently occupied and the water supply well has been shut down. Bottled water is provided to the business. Therefore, there is no current risk to human health or the environment at the Site.

Based on groundwater modeling performed in 1992, natural attenuation processes appear to be controlling the extent of the groundwater plume and the plume is expected to reach equilibrium within a period of five years from the time of the model run. However, flow and solute transport predictions can not be considered unique because they are based on limited data and approximations of the actual physical/chemical systems. Therefore, we can not be sure that the groundwater contamination will not move beyond its present boundary.

Eased on the 1992 groundwater modeling, the No Action Alternative (Alternative A) is expected to prevent further migration of contaminated groundwater into the Black Earth Creek valley. However, the No Action Alternative does not prevent migration of contaminated groundwater from the landfill boundary. Alternatives D, E and F include a groundwater extraction system designed to minimize the groundwater volume which requires extraction while maintaining

hydraulic control of the most contaminated (greater than 200 ppb total VOCs) groundwater at the Site. Alternatives D, E, and F would meet the Remedial Action Objective (RAO) of preventing migration of contaminated water at the landfill boundary.

The discharge standards for Alternatives D and E and the reinjection standards for Alternative F are based on Wisconsin Administrative Codes which are intended to protect human health and the environment. Therefore, all the pump and treat alternatives are equally protective of human health and the environment and are more protective than Alternative A. Alternative F provides additional protectiveness due to the increased speed of remediation associated with the reinjection of treated groundwater to enhance in-situ bioremediation of the contaminated aquifer.

Water Supply Alternatives

As mentioned above, the three wells currently affected by contaminants from RHL have POE systems maintained by the home owners or bottled water supplied by WDNR. Currently, groundwater is monitored semi-annually at 21 monitoring wells and annually at 12 private home wells. The RAO includes provision of potable water to residents of properties with well water that may be contaminated in the future. Both Alternative G and H would supply safe, reliable water to private wells that may be contaminated in the future and are therefore highly protective of human health. Treatment or replacement of private water supplies does not address the contamination within the aquifer and by themselves, Alternatives G and H are not protective of the environment. However, in conjunction with Source Control and Groundwater Extraction and Treatment remedies, Alternatives G and H meet the objective of overall protection of human health and the environment.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Source Control Alternatives

Alternatives A (No Action), B, and C would meet the Wisconsin Administrative Code requirements for closed landfills and would provide a landfill cover in strict conformance with NR 504.07, Wis. Adm. Code. The addition of a synthetic membrane provided by Alternative C is not required by existing state or federal requirements.

These alternatives rely upon the landfill cap to reduce contaminant loading (percolation of leachate) into the groundwater with periodic monitoring to provide information on changing groundwater conditions at the Site. Alternative C achieves the greatest reduction of contaminant loading to the aquifer. By themselves, however, Alternatives A, B, and C do not restore groundwater to NR 140 PALs within a reasonable period of time. In conjunction with a groundwater extraction and treatment alternative, the Source Control Alternatives do meet ARARs.

Groundwater Extraction and Treatment Alternatives

Alternatives D, E, and F involve extraction and treatment of the highest observed concentrations of contaminated groundwater. The unextracted groundwater (less than 200 ppb total VOCs) would exceed WDNR Enforcement Standards (ESs). However, groundwater extraction will remove the source of the contaminant plume allowing natural attenuation processes to remediate the remaining VOCs in the groundwater within a reasonable period of time. It has been determined that 20 to 40 years to meet PAL standards at this Site is a reasonable period of time because:

1. The extent and degree of groundwater contamination at the Site is known and continued plume migration is not expected.
2. A municipal water supply has not and is not expected to be affected by this Site.
3. Water supplies have been provided for the 3 affected residences and these alternative water supplies will be available for the expected time period of the remedy.

4. Additional private wells are not expected to be impacted by this Site. If additional private wells are affected by the Site, a contingency is in place to treat the water supplies so that residents would not be exposed to contaminants.
5. Considering the geologic environment and contaminant type and concentration at the Site, it is expected that the proposed remedy will restore groundwater quality over the time frame stated.
6. This time frame is less than the 100 year clean-up time frame stated in EPA guidance (EPA/540/G-88/003, Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites) and draft DNR guidance (Draft Guidance on Implementing Wisconsin's Groundwater Code, Chapter NR 140) on groundwater remedies.

It is expected that one to two flushings (equivalent to 20 to 40 years) of the aquifer will be required to achieve NR 140 PAL standards in the aquifer downgradient of the extraction system. The No Action Alternative does not return groundwater contaminant concentrations to within the NR 140 requirements within a reasonable period of time and therefore does not comply with ARARs.

Water Supply Alternatives

The groundwater contaminant plume at RHL appears to be at equilibrium. This means the plume does not appear to be moving because incoming contamination is balanced by natural attenuation processes throughout the plume. It is not believed that additional home wells will be affected by the plume. However, the possibility that the plume will move in the future or that future residential development will be affected by the plume can not be ruled out. If home wells become contaminated in the future, action must be taken to protect the residents. Both Alternatives G and H provide effective, reliable approaches for alternative water supplies.

PRIMARY BALANCING CRITERIA

Alternatives which satisfy the two threshold criteria are then evaluated according to the five primary balancing criteria.

3. Long-term Effectiveness and Permanence

Source Control Alternatives

Alternatives A, B, and C satisfy the primary balancing criteria of long-term effectiveness and permanence by maintaining the existing (Alternatives A and B) or improved (Alternative C) landfill cap, removing landfill gases for destruction and leachate for off-site treatment and disposal. Alternatives B and C provide additional long-term effectiveness and permanence compared to Alternative A by placing deed restrictions and zoning modifications and warning signs which restrict the present and future use of the landfill.

Alternative C provides the best long-term effectiveness and permanence for cap performance because it does the most to reduce percolation of water through the cap, thus reducing the amount of leachate that can percolate to luke groundwater. However, under all source control options, groundwater extraction and treatment would be required to address the risk associated with percolation of residual leachate to groundwater.

With a groundwater extraction and treatment system, the existing clay cap provides long-term effectiveness and permanence because VOC concentrations in the leachate will be significantly reduced over time as contaminants are removed through the gas/leachate extraction system and flushed from the waste and removed by the groundwater extraction system.

All the source control remedies provide long-term effectiveness and permanence when implemented with any of the groundwater extraction alternatives. With the implementation of groundwater extraction, the time required for the downgradient groundwater plume to reach NR

140 PAL standards (approximately 20 to 40 years) is the same for alternative A, B, and C.

Groundwater Extraction and Treatment Alternatives

Alternatives D, E, and F equally reduce the magnitude of residual risk through groundwater extraction and treatment. NR 140 PALs are the cleanup goal throughout the plume and this goal can be met in 20 to 40 years with Alternatives D, E, and F. The No Action Alternative may eventually meet this goal, but only after a much longer period of time. It is not possible to estimate how long it will take for the landfill to stop leaching contaminants above NR 140 ESS (Federal MCLs), therefore it can be expected that the No Action Alternative would take many decades to reach cleanup standards.

Alternatives D, E, and F provide hydraulic control of source area groundwater, preventing contaminant migration beyond the extent of the current plume. The 1992 modeling indicates that the plume should reach equilibrium within a few years indicating that the No Action Alternative would also prevent the contaminant plume from moving beyond its current boundary. However, groundwater models contain a significant level of uncertainty so confidence that No Action will result in overall plume control is much less certain than with Alternatives D, E, and F. Therefore, Alternatives D, E, and F provide the greatest adequacy and reliability of controls while Alternative A does not provide the desired adequacy and reliability of controls.

Alternatives D, E, and F provide long-term effectiveness by improving existing groundwater quality through treatment. Alternative F provides additional long-term effectiveness and permanence by enhancing in-situ bioremediation of the groundwater thus increasing the rate at which the groundwater would meet the WDNR cleanup standards.

Water Supply Alternatives

Alternatives G and H would provide long-term effectiveness by providing a potable water supply to residences whose water supply wells are impacted in the future. Alternative H (community well) is more effective in the long-term than Alternative G (POE systems) because under Alternative H only clean water would be pumped and distributed to residences resulting in a lower potential for exposure to contaminated water than POE systems offer. Alternative G requires that individual home owners properly maintain the POE systems which presents the potential for failure of the POE systems.

4. Reduction in Toxicity, Mobility or Volume Through Treatment

Source Control Alternatives

Alternatives A, B, and C provide the identical landfill gas collection and destruction system and leachate collection and off-site treatment and disposal system. Therefore, they each provide equal reduction of toxicity and mobility through treatment. The volume of leachate to be treated would be lower under Alternative C due to decreased cap percolation than under Alternatives A and B.

Groundwater Extraction and Treatment Alternatives

Alternatives D, E, and F include groundwater extraction and treatment to address areas of groundwater exceeding 200 ppb total VOCs. The 1992 groundwater model indicates that intercepting the source of the plume would result in dissipation of the remainder of the plume as the result of natural attenuation processes. Natural processes are not treatment, however they do result in a reduction of toxicity, mobility and volume of contaminants in the groundwater. Alternatives D, E, and F as well as the No Action Alternative rely on natural attenuation processes such as dilution, dispersion and degradation of contaminants in the groundwater. However, NR 140 PAL standards will not be reached at the landfill boundary within a reasonable period of time under the No Action Alternative. Alternatives D, E, and F will reduce toxicity, mobility and volume by removing contaminants from the groundwater and treating them. Alternative F is expected to provide the most efficient method of restoration

of groundwater quality since the injection of treated groundwater will enhance in-situ degradation of degradable compounds due to the addition of dissolved oxygen.

Reduction of toxicity of the groundwater is achieved by removing VOCs with an air stripper, heavy metals with chemical oxidation (and perhaps ion exchange), SVOCs and Pesticides with activated carbon adsorption. Ion exchange is proposed to meet the very strict discharge standards of the ORW portion of Black Earth Creek. This treatment step may or may not be necessary for Alternatives E (infiltration gallery) and F (reinjection wells), depending on final effluent limits and maintenance requirements of the galleries or injection wells.

Discharge of VOCs into the air is not expected to increase the potential risks to human health and the environment. All pertinent air standards are expected to be achieved with the proposed groundwater treatment system. If VOCs exceed air standards, off-gas treatment would be installed. The treatment system will also produce heavy metals, solids, and sediments that would form a sludge which would need to be disposed of in a permitted solid waste of hazardous waste landfill, as required by the sludge characterization. The activated carbon and ion exchange resin would require occasional regeneration to remove contaminants from those materials.

Water Supply Alternatives

Only Alternative G includes treatment of groundwater prior to use as potable water. This treatment will reduce toxicity, mobility, and volume of contaminants similar to the groundwater extraction and treatment alternatives because it will remove the contaminants from the groundwater. The amount of reduction achieved by individual POE units is much less than that achieved by the groundwater extraction and treatment alternatives.

5. Short-term Effectiveness

Source Control Alternatives

Implementation of Alternatives A, B or C will provide protection to the community through groundwater monitoring, landfill gas control and monitoring and leachate control and monitoring. There is no substantial risk associated with construction of any of the landfill cap alternatives because the clay cap containing the waste will remain in place under all source control alternatives so there will be no direct contact with waste. Under Alternative C, physical risks associated with construction will be present, but these should not significantly affect the protection of human health or the environment.

Groundwater Extraction and Treatment Alternatives

Construction and implementation of Alternatives A, D, E, and F would not result in risks to human health and the environment from the waste or groundwater. Physical risks are present at any construction project. Construction of Alternatives D and E would entail much greater land disturbance than Alternatives A and F. Construction of Alternative F will be largely limited to the Site property boundary with some construction on the property immediately adjacent and east of the Site. The clay cap will not be disturbed under any groundwater extraction and treatment alternative. Extreme caution and appropriate health and safety precautions would be employed during any activities where there is potential for exposure to contaminated water.

Alternative F would be more effective in the short-term than Alternatives D and E because Alternative F would enhance in-situ bioremediation of the contaminated groundwater.

Water Supply Alternatives

There is currently one contaminated private home well (the Randall Swanson property) that is not in use. However, if a new well is installed or the existing well is upgraded, a POE system will be required to treat the contaminated groundwater. At two other residences with contaminated well water, POE systems are effectively treating the well water. If additional

homes become contaminated in the future, POE treatment systems (Alternative G) are more effective in the short-term than a community water supply well (Alternative H) because POE systems can be installed quickly while a community water supply system, including a well, elevated storage and distribution system would need to be designed and constructed. In addition, POE units can be installed in individual homes while several homes would likely need to be threatened or affected before it would be practical and cost effective to install a community water supply system.

Implementation of Alternative G or H would not result in risk to human health or the environment from contact with waste or groundwater. All construction projects involve physical risks, however the physical construction risks associated with Alternative G are minimal.

6. Implementability

Source Control Alternatives

Required materials, services and equipment are available to implement each source control alternative. Operation and maintenance of the existing systems at the Site have already been implemented. Alternative A involves no construction and is the easiest to implement. Alternative B involves placement of warning signs and deed restrictions and is only marginally more difficult to implement than Alternative A. Alternative C involves placement of a composite cover (and warning signs and a deed restriction) and would require care in construction to minimize potential damage to the existing leachate and gas recovery system.

Groundwater Extraction Alternatives

Required materials, services and equipment are available to construct each of the groundwater extraction and treatment alternatives. Alternative A involves no construction and is easiest to implement. Construction of the groundwater extraction and treatment system proposed in Alternatives D, E, and F would be easily implemented from a technical and administrative standpoint. The major difference for these alternatives is the implementation of the discharge or reinjection system, as follows:

- Discharge to the ERW segment of Black Earth Creek (Alternative D3) would be easiest to implement administratively. The ERW segment has the greatest assimilative capacity for the discharge of treated groundwater and it would be easier to receive WDNR approval for a discharge to this segment of the creek. However, it is likely the most difficult to implement technically because it involves building a 5 mile discharge pipe. Many easements through private property and through the City of Cross Plains would be required as well as significant disturbance of land.
- Discharge to Alternative D4 (East Fork of Pheasant Branch Creek) would be somewhat more difficult to implement administratively than D3 because this "warm water fishery" water has less assimilative capacity than the ERW portion of Black Earth Creek. This alternative would be somewhat difficult to implement from a technical standpoint because it requires a system to lift the treated water 220 feet vertically and then discharge it one mile north of the landfill.
- Discharge to Alternatives D1 and D2 (ORW portion of Black Earth Creek) are the most difficult to implement administratively. The ORW is very sensitive environmentally and a discharge to this segment is unlikely to be approved by the WDNR. Water temperature and volume concerns as well as water quality concerns must be addressed for any discharge to these locations. These locations are closest to the landfill and require the least land disturbance for building a discharge line.
- Alternative E (infiltration gallery) may be difficult to implement administratively. The only acceptable gallery locations are downgradient of RHL and location is further limited by roadways and surface water bodies. It is estimated that a minimum 250 foot setback from a surface water body or roadway is necessary to minimize potential

disturbances between the discharge location and these other areas. A minimum of 2 acres of land is needed for the gallery as well as access to the property.

- Alternative F may be difficult to implement technically. Alternative F is an innovative technology and has more unknowns associated with it than the other alternatives. Pump tests in both the extraction and injection well areas are needed as well as treatability studies associated with enhancing the in-situ biodegradation. Alternative F has additional O&M issues compared to surface water discharge alternatives. It is likely that Alternative F would be considered an on-site action and no permits would be necessary (under federal authority).

Water Supply Alternatives

All water supply alternatives are implementable. Alternative A, No Action, is easiest to implement. Alternative G is next easiest from a technical standpoint because it involves installation, operation and maintenance of small scale treatment systems which are readily available and have been demonstrated to effectively treat the contaminated groundwater. Alternative H would be more difficult to implement because larger scale construction would be required for a community well and a piping network system.

7. Costs

Cost Summary

Description	Total Direct Cost (\$)	Annual O&M (\$)	Present Worth (\$)
SOURCE CONTROL ALTERNATIVES			
A. No Further Action	0	100,000	1,376,000
B. Limited Action 1	7,000	100,000	1,383,000
C. Construct a Composite Cover on Landfill	2,876,000	75,000	3,908,000
GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE ALTERNATIVES			
D1 Discharge to BEC via Drainage Ditch, SE, of landfill	706,000	164,000	2,963,000
D2 Discharge to BEC at Twin Valley Road	903,000	164,000	3,160,000
D3 Discharge to BEC at Cross Plains	1,474,000	162,000	3,704,000
D4 Discharge to East Fork of Pheasant Branch Creek	750,000	162,000	2,980,000
E. Discharge to an Infiltration Gallery	1,116,000	154,000	3,236,000
F. Discharge by Injection Wells	576,000	157,000	2,737,000

WATER SUPPLY ALTERNATIVES

G. Supply Individual Water Treatment Units	220,000 (ea. 6,000)	62,500 (ea. 2,500)	1,080,000
H. Construct Community Well	783,000	50,000	1,471,000
TOTAL, SELECTED ALTERNATIVES	810,000	319,000	5,207,000

1 Shading = Selected Alternatives

MODIFYING CRITERIA

Alternatives which satisfy the Threshold and Primary Balancing Criteria are then evaluated according to the Modifying Criteria.

8. U.S. EPA Acceptance

The WDNR is the lead agency on this case and authors this ROD. EPA has been the support agency for the RI/FS and has reviewed this ROD. This RI/FS has been a fund financed action and therefore, EPA's concurrence is necessary. EPA concurs with this action and the letter of concurrence is attached.

9. Community Acceptance

A Proposed Plan was prepared and released to the public on February 6, 1995. A 30 day public comment period was conducted between February 13, 1995 and March 14, 1995. A public hearing was held on the proposal on February 23, 1995. The substantive concerns of the public included: the innovative nature of the Alternative F, the possible impacts of a residential development adjacent and upgradient of the Site, concerns for any discharge to Black Earth Creek, and possible effects of the proposed groundwater extraction causing dewatering of private wells in the area. Comments and responses to those comments are described in greater detail in the Responsiveness Summary attached to this ROD. All comments to the Proposed Plan have been considered and the concerns are adequately satisfied without changes to the proposed remedy.

IX. THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, as amended by SARA, and the NCP, the detailed analysis of the alternatives and public comments, the Wisconsin Department of Natural Resources, in consultation with EPA, believes that Alternatives B, F, and G, the selected remedy, will be the most appropriate remedy for this Site. The selected remedy will be protective of human health and the environment, comply with ARARs, be cost effective, and will use permanent solutions to the maximum extent possible. The selected remedy for the Site includes the following:

Source control Alternative B:

- Deed restrictions and zoning modifications,
- Warning signs posted around the perimeter of the property,
- Maintenance of the existing single barrier (clay) cap, vegetation and surface run-off controls,
- Operation and maintenance of the existing landfill gas extraction and destruction system and leachate extraction and off-site treatment and disposal system, and
- Groundwater monitoring of selected monitoring wells and private home wells.

Groundwater Extraction and Treatment Alternative F:

- Extraction of the most highly contaminated groundwater (greater than 200 ppb total VOCs) in the vicinity of the landfill and treatment of groundwater to meet applicable groundwater discharge standards,
- Injection of the treated water into the aquifer upgradient of the landfill to stimulate in-situ biodegradation of degradable components of the contamination, and
- Monitoring and evaluation of the effectiveness of the groundwater extraction, treatment and reinjection system in achieving progress toward cleanup standards.

Water Supply Alternative G:

- Supply a point-of-entry treatment system for any private well exhibiting contaminants originating at the Refuse Hideaway Landfill with concentrations exceeding NR 140 Enforcement Standards (Federal MCLs) or that are believed by the WDNR and EPA to be imminently at risk for exceeding those standards.
- Construct a community water supply well if the number of homes requiring replacement water supplies makes Alternative H cost effective.

With the exception of the deed restriction/zoning modification and warning signs, Alternative B has already been implemented at the Refuse Hideaway Landfill. Therefore, once the deed restriction/zoning modification and warning signs are in place, the primary Source Control activity will be operation and maintenance of the existing clay cap and surface vegetation cover and leachate and gas extraction system. Monitoring of these systems may indicate that changes/additions to these systems are needed in the future to optimally run the extraction systems and protect human health and the environment. At this time the landfill has a fairly good vegetative cover. Any necessary reseeding of the cover should include consideration of plant species that would provide wildlife habitat on and near the landfill, within the constraints of the cap integrity and post-remediation land uses.

In performing this remedy, all preliminary field testing (such as aquifer pump tests) and all construction activities for remedial support activities and groundwater treatment facilities (e.g., roads, pipelines, staging areas) will be accomplished by avoiding impacts to fish and wildlife habitats. If any fish or wildlife habitat is negatively affected, the damage will be restored/replaced to the extent practicable.

Alternative F will require, at minimum, two aquifer pumping tests to determine the proper placement and design of the projected four extraction wells on the west and south sides of the landfill and the two injection wells on the east side of the landfill. Aquifer and groundwater samples will be necessary for conducting bench scale treatability tests for optimizing the above ground treatment plant design and the in-situ degradation component of the remedy. It is likely that field pilot tests of the extraction, treatment and injection system will be necessary. Design of the field testing program will need to address treatment and discharge of water (both clean and contaminated water) during the aquifer pumping tests and other field activities that may generate waste water. All waste waters generated are likely to require containerization and testing for contaminants with approval for a short term discharge to Madison Metropolitan Sewerage District or some other discharge location.

After design and required agency approvals, Alternative F will require installation of four extraction wells at the landfill pumping groundwater at approximately 45 gallons per minute with a goal of capturing all groundwater contaminated above 200 ppb total VOCs. It is expected that this will adequately contain the source of the contamination and cut off the downgradient plume from additional contaminant input. A monitoring system will need to be designed to evaluate the effectiveness of the capture system. The estimates for cleanup of the plume downgradient of the landfill (20 to 40 years) depend upon completely severing the escaped plume from the source of the contamination. Natural attenuation processes of dispersion, degradation and adsorption should remediate the plume downgradient of the landfill in 20 to 40 years (the equivalent of one to two aquifer flushings). It is difficult to determine how long it will take to clean up the contaminated aquifer beneath the landfill because it is not known how long the landfill will continue to leach contaminants into the

groundwater.

Design of the treatment plant will be based on the influent contaminant concentrations from the aquifer pump test for the extraction wells as well as on final water quality effluent limits and BAT for discharge into groundwater as determined by the WDNR. It is expected that the treatment system will consist of:

- a flow equalization tank,
- a chemical precipitation step,
- a flocculation tank, clarifier and in-line filter to remove the metal precipitates from the chemical precipitation treatment,
- an air stripper for VOC removal, an activated carbon adsorption system for removal of SVOCs and pesticides, if necessary, and
- an ion exchange step to remove trace metals, if necessary.

Because only one SVOC and two pesticides were detected at low levels in groundwater, it is possible that further analysis will show that activated carbon adsorption is not necessary. In addition, ion exchange may not be necessary depending on the influent concentrations, the effectiveness of the chemical precipitation step and the effluent limits. The goal of the final groundwater treatment system is to reduce contaminants in groundwater such that human health and the environment are protected, ensure that ARARs are met and ensure that the injection system functions as effectively as possible. Special treatment approaches may be necessary to keep the injection wells from clogging with Precipitates, suspended solids, bacteria, etc. Therefore, the final design of the treatment plant and the technologies used may differ from those listed above. In addition, treatability studies may indicate that materials other than oxygen would be useful to stimulate in-situ degradation of the groundwater contaminants. If this is the case, the treatment plant may include feed systems to add the appropriate concentrations of materials to the effluent water before injection into the groundwater.

Alternative F will require the installation, operation and maintenance of an injection well system. It is proposed that two injection wells be installed upgradient (east) of the landfill and that 45 gpm of treated water be pumped into these wells.

An aquifer pump test(s) will be required to properly site these injection wells such that the sand and gravel aquifer can reliably and over time accept the anticipated flow volume. It is possible that more than two injection wells will be needed or that their location will need to be adjusted. A monitoring system will need to be designed that monitors the effect of the injection of treated water on the aquifer flow system and confirms that treated groundwater does not significantly alter aquifer flow patterns, as projected in the 1994 groundwater modeling study (Numerical Evaluation and Design of a Wellfield). The injection wells will need maintenance to prevent excessive head build up, this would likely require acid treatment of the wells on a periodic basis.

It is not expected that the groundwater plume will move beyond its present boundaries. However, private home wells may become contaminated in the future if the plume does move or if wells are developed in the existing plume. In addition, one home/business well is currently contaminated but not in use. If the home/business owner wishes to put the well back in use or install a new well on the property, treatment of the water would be necessary. This remedy calls for installation of point-of-entry (POE) treatment systems at private wells that are impacted with contaminants from the Refuse Hideaway Landfill above NR 140 Enforcement Standards (Federal MCLs) or that are imminently at risk of becoming contaminated above NR 140 ESs. If it appears that the number of residences likely to be affected by the contamination from RKL would make it cost effective to install a community water supply well, then WDNR and EPA should consider installing a community water supply well (Alternative H) to serve the homes.

Periodic reviews (usually every 5 years) of remedy performance will be necessary to evaluate all remedial actions undertaken at the Site compared against the cleanup objectives. These reviews will provide recommendations on implementing additional remedial actions, such as

installation of additional groundwater or gas/leachate extraction wells and/or adjusting current system operations. This review will also help evaluate time frames to reach cleanup objectives.

The remedial action objectives (RAOs) and clean-up goals for this remedy are presented in Section VII of this ROD. The remedial action objectives include:

Source Control RAOs:

- Prevent direct contact with landfill contents;
- Minimize contaminant leaching into groundwater;
- Prevent migration of landfill gas;
- Control surface water run-off and erosion; and,
- Attain compliance with all identified Federal and State ARARs.

Groundwater RAOs:

- Attain NR 140 PALs for all groundwater affected by RHL at and beyond the landfill boundary;
- Reduce the potential for exposure to contaminants in groundwater; and,
- Attain compliance with all identified. Federal and State ARARs.

Water Supply RAOs:

- Provide potable water to residences with impacted private well water.

WDNR and EPA believe the selected remedy will achieve the remedial action objectives. The remedy is protective of human health and the environment, meets ARARs, is cost effective and is permanent.

COST SUMMARY FOR THE SELECTED REMEDY

Capital Costs	Estimated Cost
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Source Control, Alternative B

Deed Restrictions	\$ 1,000
Zoning Modification	\$ 5,000
Construct & Install Warning Signs	\$ 1,000

Groundwater Extraction & Treatment, Alternative F

GW Extraction/Treatment System	\$ 376,000
Install Injection Wells	\$ 8,000
Subsurface Pipeline to Injection Wells	\$ 15,000
Property Acquisition	\$ 10,000
Mobilization/Demobilization	\$ 41,000

Other Direct Costs

Permitting & Design	\$ 45,000
Construction Oversight	\$ 36,000
Contingency	\$ 45,000

Supply Individual Water Treatment Units, Alternative G

Purchase/Install Individual Water Treatment Units (25 @ \$6,000 ea.)	\$ 150,000
Purchase & Set up Computer & Software to Track & ID New Wells in Area	\$ 6,000
Mobilization/Demobilization	\$ 16,000

Other Direct Costs

Permitting & Design (10% of Capital Costs)	\$ 17,000
Construction Oversight (8% of Capital Costs)	\$ 14,000
Contingency (10% of Capital Costs)	\$ 17,000

TOTAL CAPITAL COST	\$ 810,000
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COST SUMMARY FOR THE SELECTED REMEDY (continued)

Operation and Maintenance Costs	Annual Cost
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Source Control, Alternative B

Annual Inspection of Landfill Cap
O&M Leachate/Gas Collection System
LF Gas Sampling & Analysis

Off-Site Disposal of Leachate	\$ 75,000
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Semi-annual Groundwater Monitoring
(21 wells)

Annual Private Well Monitoring (12 wells)	\$ 25,000
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Groundwater Extraction & Treatment, Alternative F

Groundwater Extraction & Treatment System	\$ 140,000
Maintenance of Injection Wells	\$ 5,000
Monthly Water Discharge Sampling & Analysis	\$ 12,000

Supply Individual Treatment Units, Alternative G

Equipment O&M	\$ 62,500
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TOTAL ANNUAL O&M	\$ 319,000
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TOTAL COSTS	\$ 5,207,000
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(Net Present Worth calculated using a 6% discount rate)

X. STATUTORY DETERMINATION

The selected remedy must satisfy the requirements of Section 121 of CERCLA to:

- a. protect human health and the environment,
- b. comply with ARARs,
- c. be cost effective,
- d. use permanent solutions and alternate treatment technologies to the maximum extent practicable, and
- e. satisfy the preference for treatment that reduces mobility, toxicity, and volume as a principal element of the remedy or document in the ROD why the preference for treatment was not satisfied.

The implementation of Alternative B, F and G satisfies the requirements of CERCLA as detailed below:

A. Protection of Human Health and the Environment

The selected remedy provides protection of human health and the environment by addressing source control of landfilled wastes, groundwater contamination and providing alternate water supplies if private water supplies in the area become contaminated. Source control includes waste containment, leachate treatment, control and destruction of landfill gases and operation and maintenance of these systems. In addition, warning signs and a deed restriction/zoning modification will protect potential trespassers and future use of the Site.

Groundwater extraction, treatment and injection for in-situ biodegradation will contain the source of the groundwater plume, allow the downgradient plume to dissipate due to natural attenuation, flush the aquifer with clean water and stimulate natural microbes to break down contaminants in the aquifer. Treatment of groundwater will ensure that the air media as well as the groundwater are protected into the future. By avoiding any discharge or impact on Black Earth Creek, this remedy protects a fragile environmental resource while addressing the contaminated aquifer.

The remedy provides a contingency in case private water supplies become contaminated in the future. Point-of-entry treatment systems have proven effective at two homes near the RHL. Installation of POE systems on any well that becomes contaminated above NR 140 ES (Federal MCL) limits will ensure the protection of public health. It is expected that a POE system will be installed at the Randall Swanson residence if a State-complying water supply well is installed on the property.

B. Attainment of ARARs

The selected remedy will be designed to meet all applicable, or relevant, and appropriate requirements under federal and state environmental laws. Because the Refuse Hideaway Landfill will be conducted under federal authority, a CERCLA on-site permit exemption is available. Only the substantive aspects of permits and approvals required to implement the remedy must be complied with. The primary ARARs that will be achieved by the selected alternative are:

1. Action specific ARARs

Resource Conservation and Recovery Act, as amended [42 U.S.C. Sec. 6901 et seq.]; Wisconsin Environmental Protection Law, Hazardous Waste Management Act [Wis. Stat. Sec. 144.60-74]

Most RCRA requirements are administered under the State of Wisconsin's implementing regulations. WDNR does not have sufficient evidence to demonstrate that listed RCRA wastes were disposed of at the Site. RCRA requirements are therefore not applicable to the Site, except to the extent that new hazardous wastes (such as treatment residuals) are generated

during the course of the remedy. This remedy will comply with the following applicable requirements:

Wis. Adm. Code NR 605; 40 CFR 261 - Identification of Hazardous Wastes. This code provides requirements for determining when a waste is hazardous. The substantive requirements of these regulations will apply to any on-site TCLP testing of treatment residuals which may be disposed of off-site. No waste excavation is anticipated during this remedy.

Wis. Adm. Code NR 615; 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste. This code provides requirements for the shipment of wastes to treatment, storage or disposal facilities. These requirements may apply to on-site preparations for off-site shipment of treatment residuals and other wastes.

Wis. Adm. Code NR 620; Department of Transportation Hazardous Materials Transportation Act [49 U.S.C. Sec. 1801]; 40 CFR 263 - Standards Applicable to Transporters of Hazardous Waste. This code requires record keeping, reporting and manifesting of waste shipments. These requirements may apply to on-site preparations for off-site shipment of treatment residuals and other wastes.

Wis. Adm. Code NR 630.10-17; 40 CFR 264, Subpart B - General Facility Requirements. This code establishes substantive requirements for security, inspection, personnel training, and materials handling which are relevant and appropriate to on-site activities involving handling of hazardous materials. These requirements may apply to on-site preparations for off-site shipment of treatment residuals and other wastes.

Wis. Adm. Code NR 630.21-22; 40 CFR 264, Subpart D - Contingency Plan and Emergency Procedures. This code establishes substantive requirements for emergency planning which are relevant and appropriate for on-site activities which may involving handling of hazardous substances.

Wis. Adm. Code NR 675; 40 CFR 268 - Land Disposal Restrictions. This code requires that hazardous wastes cannot be land disposed unless they satisfy specified treatment standards and imposes record keeping requirements on such wastes. These requirements apply to on-site activities related to off-site disposal of any treatment residues or other hazardous wastes.

Wisconsin Environmental Protection Law, Subchapter IV - Solid Waste [Wis. Stat. Sec. 144.43-47]

Wis. Adm. Code NR 504; RCRA Subtitle D Landfill Location, Performance, and Design Criteria - This code specifies locational criteria, performance standards and minimum design requirements for solid waste disposal facilities.

Wis. Adm. Code NR 504.04, 506.08(6), 506.07, 508.04 - Landfill Gas Control - These codes establish standards for landfill gas control and monitoring practices. These requirements apply to the landfill gas recovery operations at the Site.

Wis. Adm. Code NR 506.08 - Additional Closure Standards - This code requires runoff control from closed portions of a landfill. These requirements are relevant and appropriate during construction activities at the Site. Also establishes hazardous air contaminant control for facilities over 500,000 cubic yards.

Wis. Adm. Code NR 504.07, 506.08, 514.07, and 516 - Landfill Closure Requirements - These codes establish substantive requirements for design, operation and maintenance of landfill caps which are relevant and appropriate to the long-term maintenance of the existing cap.

Wis. Adm. Code NR 508 - Landfill Monitoring, Remedial Actions and In-field Conditions Reports - This code specifies monitoring requirements for groundwater, leachate, gas, surface water and air.

Wis. Adm. Code NR 700-736 - Investigation and Remediation of Environmental Contamination - This code specifies standards and procedures pertaining to the identification, investigation, and remediation of sites.

Occupational Safety and Health Administration (OSHA) - Regulates worker safety.

Clean Water Act of 1977, as amended [33 U.S.C. Sec. 1317]

Wis. Adm. Code 108 and 211; 40 CFR 403 - Pretreatment Standards - These codes prohibit discharges to POTWs which pass through or interfere with the operation or performance of the POTW. The substantive requirements of these regulations apply to the leachate which is collected and discharged to Madison Metropolitan Sewerage District.

Wis. Adm. Code NR 147, NR 214- Pollution Discharge Elimination - These codes require point source discharges to obtain a permit from the WDNR. Substantive requirements of this permit would have to be met.

Safe Drinking Water Act

Wis. Adm. Code NR 812.05; 40 CFR 144-148 - Underground Injection - This code specifies requirements pertaining to groundwater injection to remediate soil and groundwater; also specifies private well construction.

Wis. Adm. Code NR 812.37; 40 CFR 144-148 - Water Treatment - This code specifies requirements for point-of-entry treatment systems. Wisconsin Department of Industry, Labor, and Human Relations (ILHR 84) specifies plumbing product requirements for use of POE systems.

2. Chemical Specific ARARs

Clean Air Act [42 U.S.C. Sec. 7401 et seq.]; Wisconsin Environmental Protection Law, Subchapter III- Air Pollution [Wis. Stat. 144.30-144.426]

Wis. Adm Code 404, 415-449; 40 CFR 50 - Emissions Standards. These codes establish standards for emission of pollutants into ambient air and procedures for measuring specific air pollutants. Groundwater treatment requires removal of VOCs before injection. The need for treatment of air emissions produced by this process would be evaluated based on substantive requirements of Wis. Adm. Code NR 445. If emissions are expected to exceed those standards, the selected remedy will include treatment of air emissions.

OSWER Directive 9355.0-28

This directive controls of air emissions from superfund air strippers at superfund groundwater sites. The emission thresholds are: 3 lb/hr or 15 lb/day or a potential rate of 10 tons/yr of total VOCs.

Resource Conservation and Recovery Act (RCRA), as amended [42 U.S.C. Sec. 6091 et seq.]; Wisconsin Environmental Protection Law, Hazardous Waste Management Act [Wis. Stat. Sec. 144.60-74]

The following RCRA regulations are not applicable but are relevant and appropriate.

40 CFR 265.1032-33 - Air emission standards for process vents. This regulation establishes emission standards for certain air stripper operations. Air stripper emissions at RHL are expected to meet applicable standards under these regulations. As with the Clean Air Act standards described above, treatment of these air stripper emissions would be included if necessary to meet RCRA air emission standards.

Safe Drinking Water Act [40 U.S.C. Sec. 300 et seq.]

Wis. Adm. Code NR 109; 40 CFR 141 - Maximum Contaminant Levels (MCLs) - MCLs establish drinking water standards for potential and actual drinking water sources. MCLs have been exceeded at the Refuse Hideaway Landfill property, for a distance up to 1,500 feet upgradient of the Site and a distance approximately 3,800 feet downgradient of the landfill. Three private water supplies have been affected by contaminants from the Site. The selected remedy is intended to achieve compliance with MCLs and non-zero Maximum Contaminant Level Goals.

Wis. Adm. Code NR 140 - Groundwater Quality Standards - This code provides for groundwater quality standards including Preventive Action Limits (PALs), Enforcement Standards (ESs) and (Wisconsin) Alternative Concentration Limits (WACLs). The selected remedy is intended to achieve compliance with PALs at and beyond the waste boundary (edge of waste). To the extent it is subsequently determined that it is not technically or economically feasible to achieve PALs, NR 140.28 provides substantive standards for granting exemptions from the requirement to achieve PALs. Such exemption levels may not be higher than the ESs.

Clean Water Act of 1977, as amended [33 U.S.C. Sec. 1311-17]; Wisconsin Environmental Protection Law, Subchapter II - Water and Sewage [Wis. Stat. Sec. 144.02-27]

Wis. Adm. Codes NR 102, 105, and 220 - Surface water quality standards. NR 102 prohibits toxic substances in surface waters at concentrations which adversely affect public health or welfare, present or prospective water supply uses, or protection of animal life. NR 105 sets compound-specific surface water quality standards. The selected remedy will achieve compliance with any substantive requirements of these regulations that constitute ARARs for discharge to on-site groundwater, including NR 220, Wis. Adm. Code WPDES Best Available Technology (BAT) requirements at the point of injection to groundwater.

Wis. Adm. Code NR 207; 40 CFR 131 - Ambient Water Quality Criteria. Establishes pollutant concentration limits to protect surface waters. These and other water pollution discharge limits are administered under the Wisconsin Pollutant Discharge Elimination System (WPDES) permit program. The selected remedy would satisfy both general and specific substantive requirements for discharge to on-site groundwater through injection wells. Any waste discharged to a surface water must, if necessary, be treated to satisfy these standards prior to discharge. These treatment requirements are administered under NR 200 and 220, Wis. Adm. Code. Any new discharge to an ORW or ERW classified stream must meet the requirements of NR 207, Wis. Adm. Code, Water Quality Antidegradation. The substantive requirements of these regulations will apply to extracted groundwater to be discharged.

3. Location Specific

Clean Water Act of 1977, as amended [33 U.S.C. Sec. 1344]

Wis. Adm. Code NR 103 - Water Quality Standards for Wetlands; Executive Order 11990 and 40 CFR 6 - Protection of Wetlands - These requirements provide protection against loss or degradation of wetlands. A wetland is located southeast of RHL. The proposed remedy should not have an adverse impact on the nearby wetland.

C. Cost Effectiveness

The selected remedy provides for overall cost effectiveness. The combination of source control using the existing clay cap and groundwater extraction and treatment provides overall protection of human health and the environment into the future and achieves this in a cost-effective manner. The estimated time for clean up of the downgradient groundwater contamination is 20 to 40 years under all landfill capping/groundwater extraction scenarios considered. The estimated cost of the selected remedy, \$5,207,000, is the most cost effective combination of the Alternatives evaluated.

D. Use of Permanent Solutions and Alternative Treatment Technologies

The selected remedy represents the best balance of alternatives with respect to the nine evaluation criteria described in Section VIII and utilizes permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy includes the innovative technology of in-situ biological treatment of aquifer contaminants in an effort to speed groundwater remediation and limit overall impact on surrounding environmental resources.

E. Preference for Treatment as a Principal Element

The remedy provides for extraction and treatment of leachate and landfill gas from the landfill. Contaminated groundwater will also be extracted and treated and injected back into the aquifer to stimulate additional treatment in-situ. Therefore, the selected remedy satisfies the statutory preference for treatment as a principle element to permanently and significantly reduce toxicity, mobility, or volume of hazardous substances.

APPENDIX A

RESPONSIVENESS SUMMARY

Refuse Hideaway Landfill Record of Decision

Town of Middleton, Dane County, Wisconsin

This responsiveness summary has been prepared to meet the requirements of sections 113(k) (2) (iv) and 117(b) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which requires a response ". . . to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on a Proposed Plan for remedial action. The Responsiveness Summary addresses concerns expressed by the public, potentially responsible parties (PRPs), and governmental bodies, in comments received regarding the Proposed Plan for the remedial action at the Refuse Hideaway Landfill.

Public Comment Period

A public comment period was held from February 13, 1995 through March 14, 1995, to allow interested parties to comment on the Proposed Plan, in accordance with section 117 of CERCLA. On February 23, 1995, a public meeting was held at the Town of Middleton Town Hall, at which the Wisconsin Department of Natural Resources (WDNR) and the U.S. Environmental Protection Agency (U.S. EPA) presented the Proposed Plan, answered questions and accepted comments from the public. Comments received during this period are included in this Responsiveness Summary.

The Remedial Investigation Report (RI), Feasibility Study (FS) and the Proposed Plan for the Refuse Hideaway Landfill Site were released for public review in February, 1995. The Administrative Record was made available to the public prior to the comment period, at the City of Middleton Public Library, the WDNR central office in Madison, Wisconsin, and at U.S. EPA's Region 5 office in Chicago, Illinois.

Community Interest

There is a great deal of public interest in the Refuse Hideaway Landfill. The WDNR conducted an extensive public information program for several years before Refuse Hideaway became a Superfund Site. Public concern centers on protection of groundwater quality and private well water, protection of Black Earth Creek as a high quality fishery, and the effect the landfill has on land values in the area.

Summary of Comments Received and Agency Responses

The following summarizes comments received from the public during the February 23, 1995 public hearing or received in written form during the 30 day public comment period (February 13 to March 14, 1995).

Comment: A deed restriction should be placed on the landfill property, the Site should be condemned and all activities not related to cleanup (including equipment storage and shop operations) should be prohibited at the Site.

Reply: The recommended remedy for Refuse Hideaway Landfill includes a deed restriction to limit development or future activities that may disturb the landfill cap or disturb remedial actions taken to protect the public and the environment. The property is currently owned by John DeBeck who rents the non- landfill portion of the property to Speedway Sand & Gravel for truck/equipment storage and repair. The property is occupied everyday by employees of Speedway Sand & Gravel. The Speedway employees maintain the access road to the property, including snow removal, and their presence helps deter potential trespassers. In addition, Speedway Sand & Gravel pays rent on the property to John DeBeck which is deposited into a

WDNR account that goes toward paying for cleanup activities at the landfill. When the groundwater remedy is in place, the activities of Speedway Sand & Gravel may need to be more limited than at this time due to space constraints and the possibility of interference with operation of the wastewater treatment system. At this time, the activities of Speedway Sand & Gravel do not interfere with management of the landfill Site and the landfill poses little risk to the employees of Speedway.

Comment: Speedway Sand & Gravel is believed to be removing rock and sand & gravel from the landfill property. This should be stopped immediately.

Reply: Contractors for the WDNR have worked at the landfill for the past 5 years. At no time have the contractors ever reported mining of the bedrock ridge immediately northeast of the waste mass or removal of any sand and gravel or other natural materials from the property. In addition, there is no physical evidence of quarrying on the Site - the exposed bedrock is weathered. Removal of rock or sand and gravel materials from the landfill is not allowed and would be stopped if undertaken.

Comment: More cover soil and grass seeding should be added to the landfill cover as well as tree plantings.

Reply: The cover is maintained to eliminate, to the extent possible, soil erosion. A good vegetative cover is essential to this goal. Additional topsoil and seeding will be added in any areas of the landfill requiring this maintenance. Currently, the landfill cover is healthy and preventing erosion. Trees are usually not planted on a landfill surface because the deep tree roots can penetrate the clay cap and create channels for surface water to directly seep into the waste. To the extent practical, efforts would be made to use plant species native to southern Wisconsin that would provide good soil cover and wildlife habitat.

Comment: All residential wells in the area, particularly south of the landfill, should be tested for VOCs annually.

Reply: The groundwater flow and the VOC plume emanating from the Refuse Hideaway Landfill have been well delineated. The private homes that are in the path of the contaminated groundwater will be tested annually under the proposed remedy. Testing of additional private homes would be done if groundwater contamination appears to threaten additional homes. The groundwater monitoring that is in place at the landfill should adequately monitor the groundwater plume, making testing of non-threatened homes unnecessary.

Comment: The Record of Decision should restrict quarry and asphalt activities across the valley from the Refuse Hideaway Landfill.

Reply: The Record of Decision can only address activities directly related to the Superfund Site. The quarry and asphalt operations are not within the scope of this decision.

Cogent: Development plans within the vicinity of the landfill should be restricted.

Reply: Again, the ROD can only address activities directly related to the Superfund Site. Development near the landfill is controlled by the Town of Middleton and other governmental authorities.

Comment: Will private home wells that are currently monitored for VOCs continue to be monitored under the proposed remedy?

Reply: Yes. All monitoring currently conducted near the landfill Site will continue to be carried out under the proposed remedy. The WDNR will continue all operation and maintenance activities and well testing programs until an agreement is reached whereby Potentially Responsible Parties take over these activities. There will not be a gap in the O&M or monitoring activities.

Comment: No potential date has been mentioned as to when the remedy will be put in place. Homeowners near the landfill expect that the "red tape" will be cut through so that the cleanup will occur as soon as possible.

Reply: We do not know at this time when the proposed remedy will be undertaken. The time frame is dependent upon negotiations with the Potentially Responsible Parties and agreement on a Consent Decree. The WDNR and U.S. EPA will work to ensure that the remedy is put in place as soon as possible.

Comment: We would like additional information regarding deed restrictions on the landfill property and any deed restrictions, rules or regulations that might affect property in the vicinity of the landfill. This should include any applicable state, federal or local restrictions.

Reply: The deed restrictions would constrain future owners of the landfill from disturbing the landfill cap or interfering with the gas/leachate collection system or any other aspect of the cleanup. The deed restrictions will only apply to the specific parcel of property where the landfill is located and would not directly affect surrounding properties. The only State rule affecting property near a landfill is a restriction on developing water supply wells within 1,200 feet of a landfill boundary. The Town of Middleton or other governmental bodies may choose to restrict certain development near a landfill. We know of no local government restrictions applying to the Refuse Hideaway Landfill.

Comment: The cost of discharging water to the ditch south of the Site seems excessively high. In addition, if the treated water is safe for human use, it should not present a problem if disposed into the creek.

Reply: The cost for discharge to the ditch south the landfill includes monitoring and investigation costs for the Outstanding Resource Water portion of Black Earth Creek. These costs are high because of the sensitive nature of the resource and the monitoring effort that would be required to ensure protection of the creek. The treated water will be very clean and would meet discharge standards set by the WDNR. However, the restrictions on discharge to the ORW portion of Black Earth Creek are due to possible impacts on the cold water fishery - these include water temperature and volume concerns as well as water quality concerns. In addition, flooding potential in the upper watershed may increase with a discharge to the ditch south of the landfill. The selected remedy, Alternative F, Reinjection of Treated Water to Enhance In-Situ Bioremediation, will avoid any impact to Black Earth Creek and will not impact flood potential in the upper watershed.

Comment: The existing municipal water supply in the City of Middleton should be considered for replacing any drinking water supplies around Refuse Hideaway Landfill.

Reply: The City of Middleton must make the determination to extend their water supply system to the Town of Middleton. On March 20, 1995, Toby Ginder, the Assistant Director and Manager of the Water Utility for the City of Middleton indicated that the Utility Master Plan would need to be amended to allow extension of a water supply main from the City of Middleton to the Town of Middleton. The water main would need to be approximately 2.5 miles long and would require several lift stations. The cost for building this extension would be quite high. In addition, Mr. Ginder indicated that a City of Middleton ordinance does not allow utility service outside the city limits. Therefore, all land served by the water main would be required to be annexed to the City of Middleton. Finally, the City of Middleton would not extend and annex land 2.5 miles from the city limits and then try to in-fill. Rather, development is done incrementally.

The WDNR and U.S. EPA do not control whether a municipality will extend its water supply, nor can the agencies dictate the conditions of that extension. Therefore, the individual water treatment devices or community water supply well have been proposed as approaches to replace water supply wells that could become contaminated in the future.

Comment: The proposed development on Airport Road might be a site for a community well serving the development and any contaminated home Site.

Reply: Development of a water supply well approximately 1 mile north or northeast of the landfill may be a good location for a water supply well for the proposed development northeast of the landfill. The major concern for threatened water supplies is about 1 mile southwest of the landfill, in the Deer Run Heights subdivision. A community water supply well to serve this area would most likely be placed in the valley, several thousand feet beyond the furthest expected extent of the groundwater contamination.

Comment: While the chosen remedy is the best option from a practical and engineering stand point, the \$5,207,000 cost is outrageous and it's doubtful that this amount of money will be available to actually complete the project.

Reply: The cost of the proposed remedy is quite reasonable compared to the average cost of Superfund cleanups - which is \$15 million to \$20 million. WDNR and U.S. EPA will attempt to negotiate an agreement with users of the landfill to pay the cleanup cost. If an agreement cannot be reached, the Site will be cleaned up using federal Superfund money.

Comment: Has the developer of the proposed 200 lot subdivision and golf course located northeast of the landfill contacted the WDNR about the proposal?

Reply: Yes, the developer did contact the WDNR about the development. The developer was told that there is a risk that the proposed 500 gpm high capacity well for the golf course will affect the groundwater contamination and may draw contamination upgradient of its present location. If the groundwater contamination does spread due to pumping by the golf course well or because of the density of private wells in the development, the developer may be liable under Superfund laws for the movement of the contamination and might therefore be considered a Potentially Responsible Party. This means the developer could be held liable for the cleanup of groundwater contamination in the vicinity of the landfill.

Comment: If it is necessary to re-introduce water upgradient to flush the plume, why was the cap placed on the landfill?

Reply: It is important to understand the functions of the cap verses the proposed groundwater pump and treat system. The cap limits, to the extent possible, surface water percolation into the waste and the subsequent formation of leachate. The leachate moves through the waste and is either removed from the landfill (by pumping to the leachate tank), is held in the landfill as part of the "field capacity" of the waste, or moves through the waste and into the groundwater. Without the cap, a much greater volume of contaminated leachate would move into the groundwater. The proposed groundwater remedy will remove contaminated groundwater from the aquifer, treat it, and inject the treated water back into the aquifer, upgradient of the landfill. There is a significant amount of contamination in the aquifer at the present time. The landfill cap slows the volume of contamination that continues to move into the aquifer. By cleaning and reinjecting the groundwater, overall cleanup time should be faster because the reinjected water will help flush contaminants out of the aquifer and will stimulate natural microbes in the aquifer to degrade ("eat") the contaminants within the aquifer. Therefore, groundwater is being treated above ground as well as below ground.

Comment: Why are the cost of the POE treatment systems at the Refuse Hideaway Landfill considerably more expensive than at other Superfund Sites?

Reply: Treatment systems are developed for each Site independently and the design of the treatment system depends upon the contaminants involved and the chemistry of the natural groundwater. For instance, iron and hardness (naturally occurring compounds in groundwater) can significantly affect the operation of a water treatment unit. While the WDNR has installed Granular Activated Carbon POE units at homes near Refuse Hideaway Landfill, other treatment units would be acceptable if the units acceptably treat the VOC contamination to no detection and provide reliable results over a long term period.

Comment: Will nearby private wells become dry because of pumping of groundwater at the Refuse Hideaway Landfill? If private wells do "dry up" because of the pumping, what will the WDNR do?

Reply: The pumping at Refuse Hideaway Landfill should have no effect on private wells in the area. The proposed 45 gpm pumping-rate will affect groundwater flow within a short distance of the landfill and will not result in significant "drawdown" of the water table. We have made every effort to limit the amount of water pumped because excess water makes the extraction and treatment system less efficient (that is, a higher pumping rate pumps clean water which then must be treated and discharged). The closest well to the proposed pumping wells is 1,600 feet northwest of the landfill. Groundwater levels will drop no more than 1 foot at 600 feet from the landfill. Areas beyond 600 feet from the landfill will be negligibly affected by the pumping system.

If a private well became dry or had some other deleterious effect believed to be due to the extraction system, the WDNR and EPA would investigate to determine the exact circumstances of the problem. If it was determined that the extraction system was causing the problem, then action would be taken to rectify the problem. These actions could range from adjusting the extraction system at the landfill to taking action at the private well to fix the problem.

Comment: The owner of the Sunnyside Seed Farm (Randall Swanson) feels that he's been discriminated against by the WDNR because a POE system has not been put in the home on his property, even though the WDNR has confirmed contamination in his well.

Reply: The WDNR designed a POE system for the Swanson property when systems were designed for the Stoppleworth/Schultz properties. Unfortunately, the well on the Swanson property did not meet WDNR standards. Mr. Swanson shut off the well rather than bring the well up to standards. The proposed remedy calls for a POE system to be installed at the home on the Swanson property if the existing well is brought up to standards or if a new well is constructed on the property. The WDNR has a "Well Compensation Program" that provides for reimbursement of up to 75% of costs for well replacement when a private well becomes contaminated. Mr. Swanson may be eligible for reimbursement of a portion of the cost of his new well under this program.

Comment: Black Earth Creek should not receive discharged treated water. The upper Black Earth Creek valley has wet soils and flooding problems already without an added discharge.

Reply: The proposed remedy calls for injecting treated water back into the aquifer, thus avoiding a discharge of water to Black Earth Creek. The proposed remedy should not have any effect on Black Earth Creek.

Cogent: Has injection of treated water been used elsewhere? Are the places it has been used similar to the area near Refuse Hideaway Landfill?

Reply: Injection of treated water is an innovative technology in Wisconsin. There are a few cleanup projects that reinfiltrate (i.e., discharge the water to trenches and let the water percolate through the soil) groundwater back into the aquifer. Injection wells have been used in a number of states around the country, including Florida and Texas. Wisconsin has not used this technology in the past because WDNR regulations prohibited the use of injection wells. In October 1994, the regulations were changed to allow the use of injection wells for remediation of contaminated soils and groundwater. The Refuse Hideaway Landfill is the first Site where this technology is being proposed. Because injection wells are allowed in other states, there are consultants qualified in using this technology. Injection wells are essentially the reverse of extraction wells, so the two types of wells are designed similarly. The greatest problem is finding the best place to install the injection wells to ensure that treated water flows freely into the aquifer throughout the remediation.

Comment: How will the WDNR know the extraction and injection system is working?

Reply: The primary control will be monitoring wells placed around the extraction and injection locations. The flow rate and water quality will, of course, be monitored. The greatest concern will be whether the extraction wells are removing water from the most highly contaminated portion of the aquifer as projected and whether the injection wells are flowing freely such that pressure does not build up in the injection wells. Water level will be measured around the extraction and injection wells. These water level measurements will help determine whether the system is functioning properly and if adjustments in flow or maintenance of wells is needed.

Comment: Why was the synthetic cap not chosen as a remedy?

Reply: It was judged that the synthetic cap was not a cost effective remedy for this Site. The synthetic liner would reduce the production of leachate and eventually result in less or no leachate being pumped by the leachate extraction wells. However, leachate will continue to be produced by the landfill and some leachate will leak into the groundwater regardless of the cap option chosen. The synthetic cap would not result in groundwater cleanup or in the groundwater meeting state standards significantly earlier than will be the case without the synthetic cap. The groundwater extraction and treatment system will eventually meet state groundwater standards - it is estimated to take 20 to 40 years to meet standards downgradient of the landfill. The type of capping system does not effect this cleanup time. Therefore, while the synthetic cap does produce less leachate, the cost (over \$2.8 million) is not justified because it does not result in a quicker groundwater cleanup.

Comment: Will the PRPs pay operation and maintenance costs for the existing POE systems at the two residences where the systems are currently installed?

Reply: Currently two home owners rely on POE systems to remove VOCs from their home wells. The systems were installed and paid for by WDNR. In 1992, operation and maintenance of the POE systems was turned over to the home owners. Operation and maintenance of all existing systems at the landfill is expected to be included in any consent agreement signed between the WDNR, EPA and PRPs. If a consent agreement is signed, we expect that this contract will also include a provision for the PRPs to take over operation and maintenance of the existing POE units at the two homes in question.

Comment: Why is the DNR and EPA so concerned with protecting the landfill cap at the Refuse Hideaway Landfill but are allowing 1,100 pilings to be driven through a landfill at Lake Monona for building of the Madison Convention Center?

Reply: The representatives of WDNR and EPA for the Refuse Hideaway Landfill are not familiar with the issues surrounding the Madison Convention Center. The Convention Center is not a Superfund site. WDNR has reviewed the land the Convention Center is being constructed on and has issued the required approvals for construction of the Center.

APPENDIX B
LIST OF FIGURES
Refuse Hideaway Landfill Record of Decision

FIGURES

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APPENDIX C

LIST OF TABLES

Refuse Hideaway Landfill Record of Decision

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# 2	Summary of VOC Detections in Private Wells
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TABLE 1, RHL ROD

SUMMARY OF NR 140 GROUNDWATER ENFORCEMENT STANDARD EXCEEDANCES 1

Constituents	ES	PAL	P-3S	P-8S	P-9S	P-9D	P-16D	P-17S			
			1/91	1/91	1/91	1/91	1/91	1/91	6/91	10/91	5/92
Benzene	5	0.5			20		7	7			
Chloroform	6	6.6									
1,2-Dichloroethane	5	0.5			41			5	9		
cis-1,2-Dichloroethene	70	7									420
1,2-Dichloropropane	5	0.5			21			10	14		15
Tetrachloroethene	5	0.5		7	16			14	18	16	18
Trichloroethene	5	0.5		16	9			28	51	65	54
Vinyl Chloride	0.2	0.02	40	160	440	32	19	68	57	57	24

1 Only post 1989 data is used in this table because pre-1989 data was not validated. The history of well testing varies for each well - some wells were monitored between 1987 and 1991 while others were monitored between 1990 and 1993.

TABLE 1, RHL ROD

SUMMARY OF NR 140 GROUNDWATER ENFORCEMENT STANDARD EXCEEDANCES

Constituents	ES	PAL		P-17S		P-18S		P-20SR		
			10/92	5/93	10/93	1/91	11/91	5/92	12/92	10/93
Benzene	5	0.5								
Chloroform	6	0.6								
1,2-Dichloroethane	5	0.5	5.7							
cis-1,2-Dichloroethene	70	7	1,900	150	350					
1,2-Dichloropropane	5	0.5	17	13	9					
Tetrachloroethene	5	0.5	18	20	14	5	7	6	6	8
Trichloroethylene	5	0.5	54	160	49					
Vinyl Chloride	0.2	0.02	24	25	10					

TABLE 1, RHL ROD

SUMMARY OF NR 140 GROUNDWATER ENFORCEMENT STANDARD EXCEEDANCES

Constituents	ES	PAL	P-21S					P-21D			
			1/91	6/91	11/91	5/92	11/92	5/93	10/93	1/91	
Benzene	5	0.5	9	7							
Chloroform	6	0.6			37						
Trichloroethene	5	0.5	7	6		5	6	9			
Vinyl Chloride	0.2	0.02	525	470	<250	56	41		5	14	
Constituents	ES	PAL	P-22S								
			1/91	6/91	10/91	5/92	10/92	5/93	10/93		
Tetrachloroethene	5	0.5	9	8	12	12	12	7	6		
Constituents	ES	PAL	P-22D								
			1/91	6/91	10/91	5/92	10/92	5/93	10/93		
Tetrachloroethene	5	0.5	6	6	8	7	8	5	8		
Constituents	ES	PAL	P-26S	P-26D	P-27S						
			1/91	1/91	1/91	6/91	10/91	5/92	10/92	5/93	10/93
Tetrachloroethene	5	0.5	38	28	114	130	150	120	130	64	50
Trichloroethene	5	0.5	7		12	17	21	16	15	8	6

TABLE 1, RHL, ROD

SUMMARY OF NR 140 GROUNDWATER ENFORCEMENT STANDARD EXCEEDANCES

Constituents	ES	PAL	P-27D								
			1/91	6/91	10/91	5/92	10/92	5/93	10/93		
Tetrachloroethene	5	0.5	99	120	150	130	54	72	91		
Trichloroethene	5	0.5	11	14	21	17	15	32	12		
Constituents	ES	PAL	P-31IA								
			11/90	12/90	1/91	6/91	5/92	10/92	5/93	10/93	
Tetrachloroethene	5	0.5	9	12	11	13	13	15	15	13	
Constituents	ES	PAL	P-31IB								
			11/90	12/90	1/91	6/91	10/91	5/92	10/92	5/92	10/93
Tetrachloroethene	5	0.5	17	14	11	13	12	10	16	14	14
Constituents	ES	PAL	P-40I								
			12/90	1/91	6/91	5692	10/92	5/93	10/93		
Tetrachloroethene	5	0.5	10	12	13	14	15	16	10		

Table #2, RHL ROD Chemicals Detected in Private Wells, Refuse Hideaway Landfill

Schultz Well

Compounds	RMT 1/21/89	RMT 2/29/88	RMT/DNR 2/29/88	DNR 3/14/88	DNR 3/16/88	DNR 8/5/88	Warzyn 10/89	Warzyn 1/90
Chloroethane	3.2	ND	ND	ND	ND	ND	ND	(19.0)
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	17.17	9.80
1,1-Dichloroethane 1	6.3	6.2	6.3	3	6.9	5.4	2.91	3.30
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	< 0.500	< 0.500
cis-1,2-Dichloroethene	NA	NA	NA	13	32	33	19.6	27.3
trans-1,2-Dichloroethene	28	46	47	ND	ND	ND	ND	ND
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	0.941	1.34
Tetrachloroethene	24	27	28	27	26	21	10.3	17.5
Toluene	ND	ND	ND	ND	ND	ND	< 0.500	ND
1,1,1-Trichloroethane	ND	ND	1.2	1.2	1.8	2.3	0.513	0.739
1,1,2-Trichloroethane	1.5	ND	0.5	ND	ND	ND	NA	NA
Trichloroethene	8	8	7.7	4.6	8.9	8.7	5.78	8.03
Trichlorofluoromethane	0.64	0.76	0.85	11	11	20	0.957	1.23
Vinyl Chloride	3.6	6	6.1	ND	ND	ND	ND	(0.842)

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Table #2, RHL ROD Chemicals Detected in Private Wells, Refuse Hideaway Landfill (Cont'd.)

Stopplesworth Well

Compounds	DNR 2/29/88	DNR 3/14/88	DNR 3/16/88	DNR 8/5/88	Warzyn 10/89	Warzyn 1/90	Hellenbrand 8/93
Chloroethane	ND	ND	ND	ND	ND	(19.5)	ND
Dichlorodifluoromethane	NA	NA	NA	NA	7.32	9.73	ND
1,1-Dichloroethane	2.1	4.9	3	3.2	2.56	2.43	1.4
cis-1,2-Dichloroethene	NA	30	13	12	8.82	8.03	6.6
trans-1,2-Dichloroethene	21	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	NA	NA	NA	NA	< 0.500	< 0.500	< 0.500
Methylene Chloride	NA	NA	NA	NA	0.888	17.4	NA
Naphthalene	NA	NA	NA	NA	0.562	ND	ND
Tetrachloroethene	31.0	24	28	22	14.1	ND	15
Toluene	ND	ND	ND	ND	< 0.500	ND	ND
1,1,1-Trichloroethane	1.1	1.2	1.4	2.2	0.619	0.765	ND
Trichloroethene	3.6	8.2	4.8	4.6	2.04	2.78	2.2
Trichlorofluoromethane	0.95	14	9.6	16.8	1.14	1.23	ND
Vinyl Chloride	5.5	1.5	ND	ND	ND	(0.507)	ND

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Table #2, RHL ROD Chemicals Detected in Private Wells, Refuse Hideaway Landfill (Cont'd.)

Swanson Well

Compounds	DNR 3/16/88	DNR 3/22/88	DNR 8/5/88	Warzyn 10/89
trans-1,2-Dichloroethene	1.5	1.5	1.4	ND
Tetrachloroethene	2.9	2.8	3.5	0.613
Toluene	ND	ND	ND	< 0.500
Trichloroethene	1	ND	1.2	NA
Trichlorofluoromethane	ND	1.1	2.3	NA

Notes:

NA = Not analyzed

ND = Not detected

() = Sample contains a compound that elutes UPC the gas chromatograph earlier/later than the indicated compound.

The result is calculated against the internal standard response.

<0.500 = Indicates the compound was detected below the quantitation limit.

All concentrations in µg/l.

1988 data from "Remedial Action Report" (RMT, 1988b).

1989 and 1990 data from "Sampling and Analysis of Residential Wells, Interim Remedial Measures" (Warzyn, 1990b).

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Table #3, RHL ROD VOC Contaminants of Concern in Landfill Gas

Risk-Based	Highest Level Detected in		EPA
	Compound	On-Site Gas* (ppb)	Concentration in Ambient Air** (ppb)
	Benzene	2,000	0.22
	Tetrachloroethylene (PCE)	26,000	3.1
	Toluene	26,000	420
	Trichloroethylene (TCE)	23,000	1
	Vinyl chloride	61,000	0.021

Notes: All values in parts per billion (ppb)

* Warzyn Engineering, Inc. Gas and Leachate Extraction System. Refuse Hideaway Landfill, Town of Middleton, Dane County, Wisconsin. Engineering Design 13928.48. Prepared for the Wisconsin Department of Natural Resources. Madison, Wisconsin: Warzyn, August 1990.

and

Mostardi-Platt Associates, Inc. Landfill Gas System Destruction Efficiency Tests. A Gaseous Study Performed for Warzyn Engineering, Inc. Refuse Hideaway Landfill. Middleton, Wisconsin. Bensenville, Illinois: Mostardi-Platt, September 30, 1991.

** EPA Region III risk based concentration table, April 20, 1994.

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Table #4, RHL ROD Ground-Water Contaminants of Concern

Compound	Units	ES	PAL	Highest Detected Concentration
Benzene	ppb	5	0.5	24
Bromomethane	ppb	NL	NL	250
Chloroform	ppb	6	0.6	37
1,2 Dichloroethane (1,2-DCA)	ppb	5	0.5	41
cis-1,2 Dichloroethene (cis-1,2-DCE)	ppb	70	7	1900
trans-1,2 Dichloroethene (trans-1,2-DCE)	ppb	100	20	640
1,2-Dichloropropane	ppb	5	0.5	21
Tetrachloroethene (PCE)	ppb	5	0.5	530
Trichloroethene (TCE)	ppb	5	0.5	320
Vinyl Chloride (VC)	ppb	0.2	0.02	525
Iron	ppm	0.3	0.15	1.45
Manganese	ppm	0.05	0.025	2.28
Bis(2-ethylhexyl)phthalate	ppb	NL	NL	92
Heptachlor	ppb	NL	NL	0.012
4,4-DDT	ppb	NL	NL	0.075

Notes: ppb = parts per billion
 ppm = parts per million
 ES = Enforcement Standard
 PAL = Preventive Action Limit
 NL = WDNR has not established an ES or PAL for this compound

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Table #5, RHL ROD

Groundwater Clean Up Standards for the Refuse Hideaway Landfill

COMPOUND	Preventative Action Level (ppb)
Benzene	0.5
Chloroform	0.6
1,2-Dichloroethene	0.5
cis-1,2-Dichloroethene	7
1,2-Dichloropropane	0.5
Tetrachloroethene	0.5
Trichloroethene	0.5
Vinyl Chloride	0.02

Table #6, RHL ROD Summary of Highest Measured Influent Ground-Water Characteristics and WDNR Proposed Water Quality-Based Effluent Standards (Page 2 of 2)

Constituent	Highest Measured Influent Concentrations	ORW+ Effluent Quality	ORW+ % Removal Required	ERW Effluent Quality	ERW % Removal Required	NR140 Effluent Quality (PAL)	NR140 % Removal Required	Warm Water Fish Effluent Quality	Warm Water Fish % Removal Required
VOLATILE CONSTITUENTS									
Benzene	61			1,500	0	0.5	99.2%	46.7	23.4%
Bromodichloromethane	8.9			1,033	0	36	0	29	0
Bromomethane	250			1,033	0	1	99.6%	29	88.4%
Chloroethane	50			No limit	0	80	0	No limit	0
Chloroform	37			1,033	0	0.6	98.4%	29	21.6%
1,1-Dichloroethane	72			No limit	0	85	0	No limit	0
1,2-Dichloroethane	41			1,800	0	0.5	98.0%	29	29.3%
Dichlorodifluoromethane	260			1,033	0	200	23.1%	No limit	0
1,4-Dichlorobenzene	7.6			1,000	0	15	0	33	0
1,1-Dichloroethene	3.3			500	0	0.7	0	16.00	0
cis-1,2-Dichloroethene	1,900			No limit	0	7	99.6%	No Limit	0
trans-1,2-Dichloroethene	640			1,800	0	20	96.8%	5,000	0
1,2-Dichloropropane	21			105,000	0	0.5	97.6%	105,000	0
Ethylbenzene	95			90,630	0	140	0	3,333	0
Methylene Chloride	74			46,671	0	15	79.7%	1,200	0
1,1,1-Trichloroethane	17			3,667	0	40	0	11,000	0
Trichloroethylene	320			3,667	0	0.5	99.8%	120	62.5%
Trichlorofluoromethane	190			1,033	0	No limit	0	29	84.7%
Toluene	200			45,600	0	68.6	65.7%	36,667	0
Perchloroethylene	530			500	5.7%	0.5	99.9%	16.33	96.9%
Vinyl Chloride	525			123	76.6%	0.02	99.996%	3	99.4%
Xylenes	480			No Limit	0	124	74.2%	No Limit	0
Total	5,783								
SEMI-VOLATILES/PESTICIDES									
Bis(2-ethylhexyl)- phthalate	92			2,967	0	No limit	0	10,000	0
4,4'-DDT	0.075			0.0014	98.1%	No limit	0	0.0001	99.9%
Heptachtor	0.012			0.14	0	0.04	0	0.00047	96.1%

Notes: All units are µg/l (ppb) unless otherwise noted.

+ = Discharge to the ORW segment of Black Earth Creek would meet all discharge standards in Appendix C, Attachment B. Limits for substances that do not occur naturally in Black Earth Creek (VOCs, SVOC, and Pesticides) are zero.

* = No data is available

** = Limits depend on naturally occurring conditions in Black Earth Creek.

ND = Not detected

ERW = Exceptional Resource Water

ORW = Outstanding Resource Water

pH and temperature data include the lowest and highest observed values.

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